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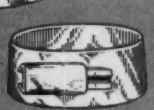

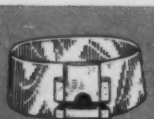

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(Editorial and Business Communications on inside back cover)

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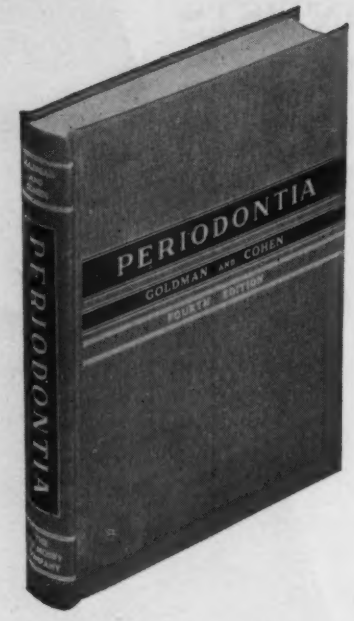

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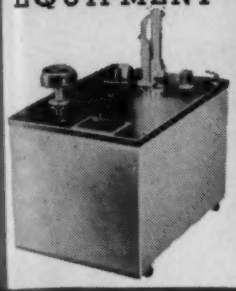

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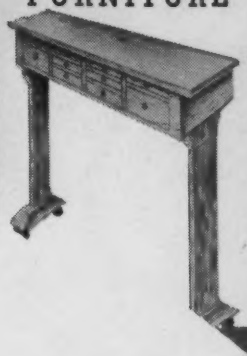

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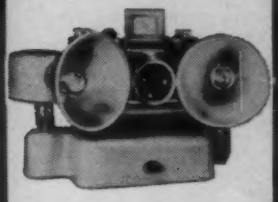

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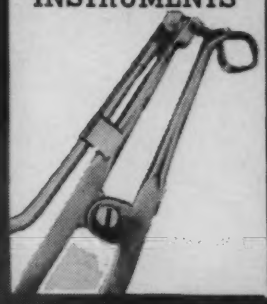

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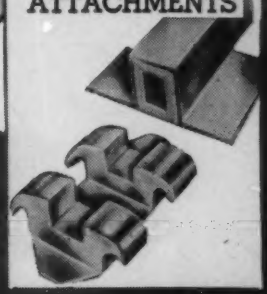

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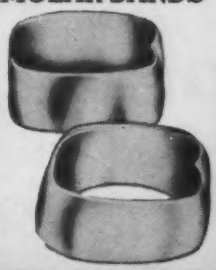

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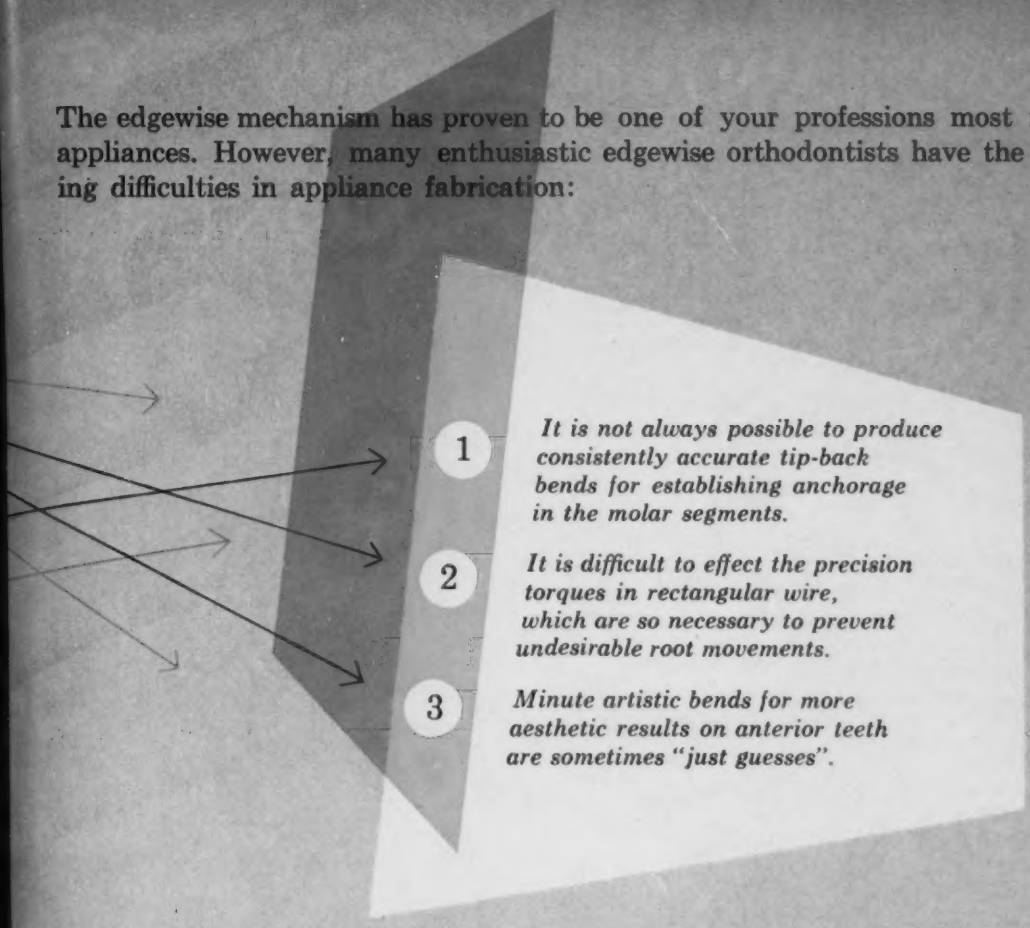

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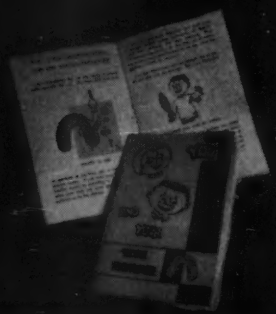

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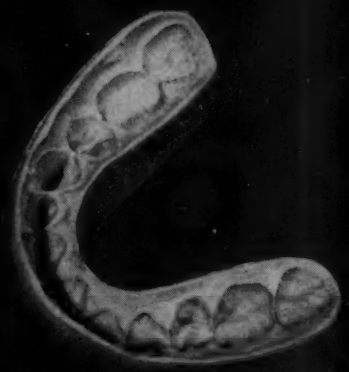

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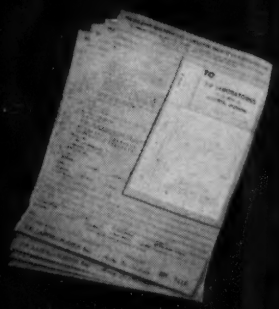

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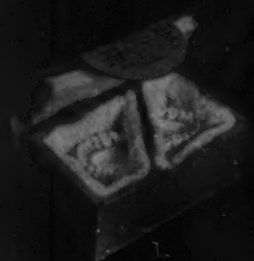

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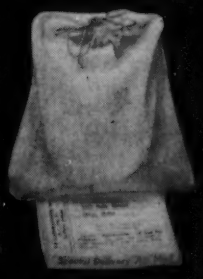

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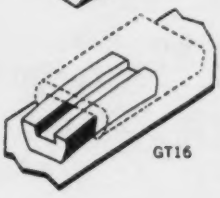
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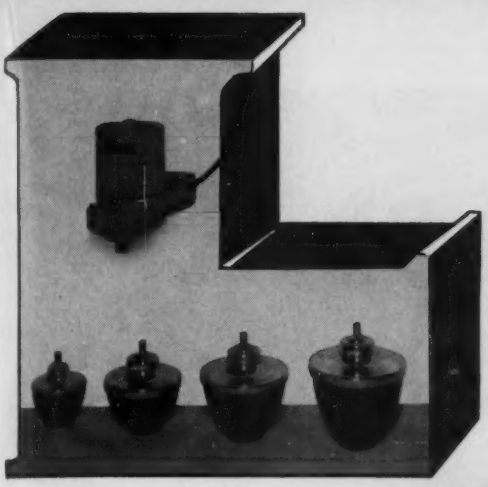

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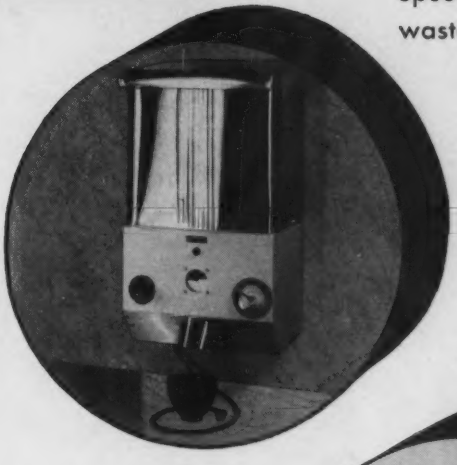

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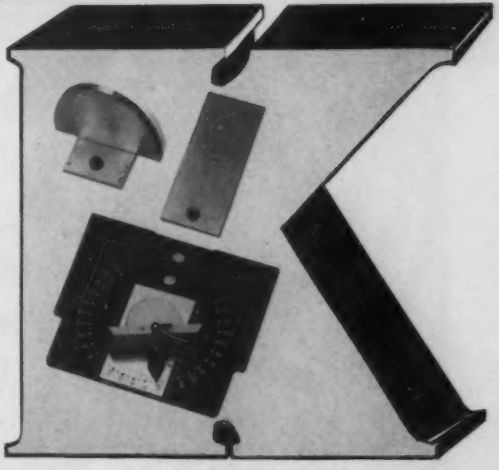

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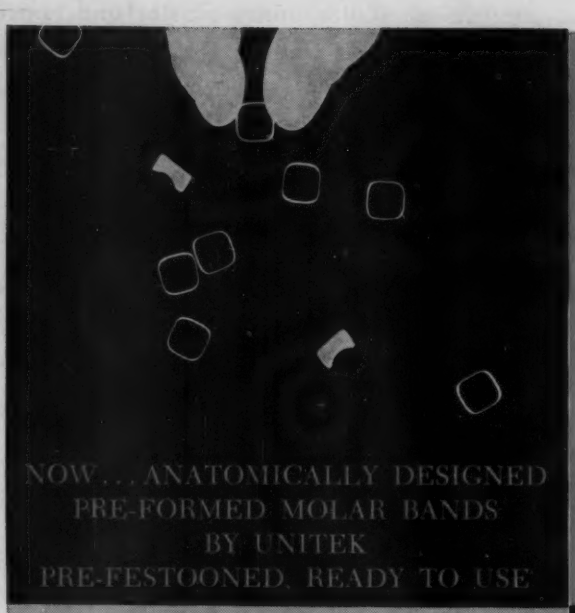

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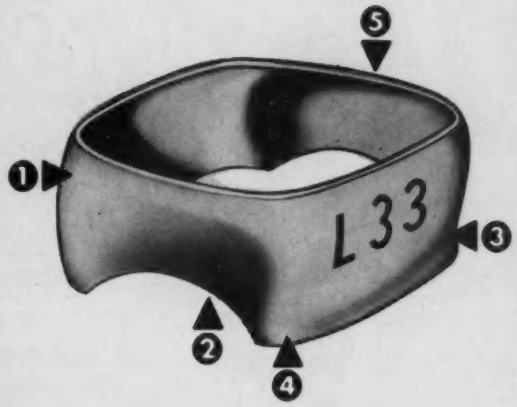

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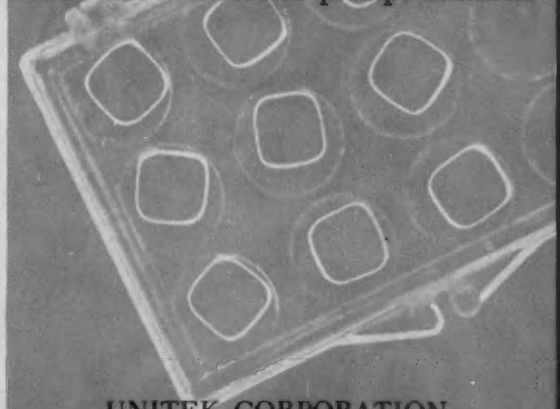

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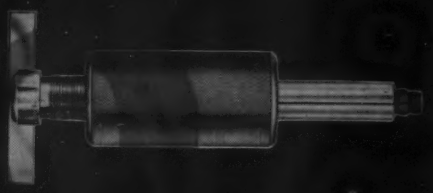

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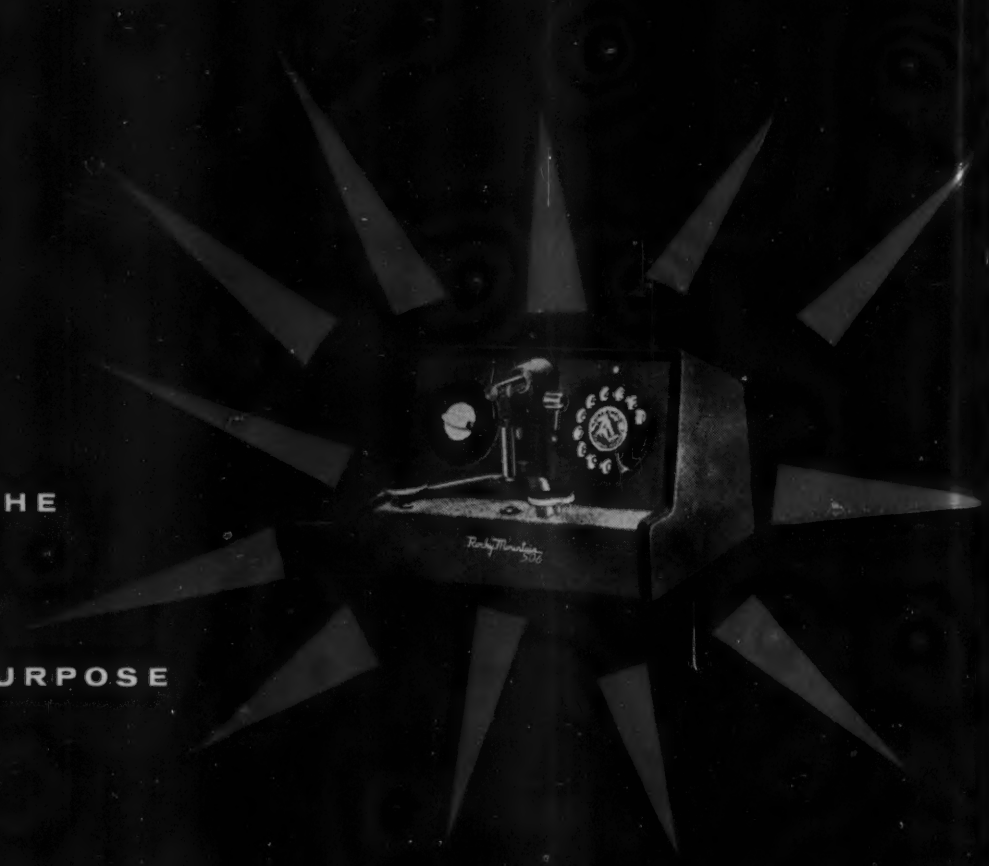

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Original Articles

PRESIDENT'S ADDRESS, SOUTHERN SOCIETY OF ORTHODONTISTS

FRANK P. BOWYER, JR., D.D.S., KNOXVILLE, TENN.

EACH year as I have watched our president approach the rostrum to present his president's address, I have wondered just how he felt deep down inside. At last I know. My friends, it is with mixed emotions that I stand before you on this occasion. There is a feeling of *pride* to have been allowed the privilege of serving such an outstanding group of men. There is a feeling of *gratitude* for all the splendid cooperation I have received during the year. There is a feeling of *admiration* for the nine men who organized our Society on Feb. 23, 1921, and for all who have guided our destiny these past thirty-six years. There is a feeling of *anxiety* as I wonder what you think of the way I have managed the administrative affairs of your Society the past year and what you will think of this meeting which is just beginning. Above all, there is a feeling of deep *humility* as I realize how small and inadequate my efforts have been in relation to the many problems that challenge us today as individuals and as a profession. Perhaps the only ones who can truly appreciate my feelings at this time are those who have enjoyed the same experience before me.

At the very beginning, I wish to acknowledge the contributions made during the year by our secretary, Hal Terry. In addition to routine duties, he had many additional responsibilities this year, since the meeting is here at Miami Beach. He accepted each one graciously and, of course, did a superb job. I know that each of you joins me in expressing our sincere appreciation.

Presented at the annual meeting of the Southern Society of Orthodontists, Miami Beach, Florida, Oct. 27, 1957.

I also wish to thank Dr. Terry's office staff for their valuable assistance—especially Mrs. Plunkett. Our assistant secretary, Henry Harrelson, has done an outstanding job in obtaining the largest number of commercial exhibitors ever to appear at a Southern Society meeting. We are all grateful to our Local Arrangements Committee for the time and effort they have spent on this meeting, and to our Program Committee for the excellent scientific program that has been arranged for us. President-Elect John Atkinson and Vice-President Bill Weichselbaum have been most cooperative at all times and have definite responsibilities during this meeting, which I know they will handle most capably. To all committees and to the many individuals who have advised and guided me through the year, I am most grateful.

If you will allow me a sentimental moment, I would like to express my gratitude to two members of this Society who have had most to do with my career in orthodontics. More years ago than either of us cares to remember, I was a patient of Bill Wood in Tampa, Florida. It was Bill who stimulated my interest in orthodontics as a profession and assisted me in obtaining the opportunity of an association with Oren Oliver. Of course, you all know of my devotion and admiration for Oren. I am indebted to him for all of my basic training and opportunities in orthodontics. So are many others. This man, who has received practically every recognition and honor which can be bestowed by dentistry on a local, state, national, and international level, has always had the time to help any deserving young man. His service to humanity is magnified many times in the lives of those whom he has trained and guided. To me, this is his outstanding contribution. Certainly, Oren A. Oliver will be recorded in the history of dentistry as one of our greatest of all time. Finally, my deep appreciation to my loyal and faithful partner, Tom Pryse, and my dear wife, Doris, who with much patience and understanding allowed me the time during the past few years to serve the Southern Society. Let us not forget that "those who wait also serve."

On Oct. 12, 1948, at Memphis, Tennessee, I was elected secretary-treasurer of this Society. With this meeting, I finish nine continuous years as one of your officers. It has been a rare privilege to serve as secretary-treasurer under presidents S. D. Gore, E. C. Lunsford, William Lewis, and Walter McFall; to serve as a director under presidents Leland Daniel, Leigh Fairbank, and Olin Owen; to serve as president-elect under Bill Jarrett; and to serve this year as your president. I sincerely appreciate each year that you have allowed me to serve you and only hope that my efforts have justified your confidence.

During these nine years our Society has grown from a membership of 100 active, 3 affiliate, and 4 honorary members, making a total of 107, to 209 active, 12 affiliate, 29 associate, 8 honorary, and 1 retired, making a total of 259.

This rapid growth is found in almost all component societies throughout the country. With this growth, many problems have developed. Some we have successfully solved. Some still confront us today. Others we see just forming

on the distant horizon. Obviously, it cannot be within the scope of these remarks to touch specifically on all of these problems. Some of these are internal problems within our profession, such as establishing requirements for membership, standardizing graduate education and preceptor or associateship training, etc. These are technical problems, and they are in the hands of competent committees at both the component and national levels. At the present, there is not much that we as individuals can do about these problems. However, there are some external problems of equal importance that we as individuals can do something about, and it is on these problems that I would like to think with you a few minutes this morning.

Thinking of some of the problems that confront us today brings to mind the story about an old, experienced mountain climber taking a friend on his first real climb to a lofty peak in the majestic Swiss Alps—a peak so high that the climbers had to spend the night on the side of the mountain before pushing on to the top. They found a suitable place, a little ledge about three feet wide, and bedded down for the night. Needless to say, the novice slept very little. He kept thinking of all the things that could happen, not the least of which was the 1,000-foot drop just to his side. Finally, he dozed off, and it seemed to him that he was immediately awakened by a cracking, crashing, and rumbling in the mountains, and it frightened him terribly. He woke the older man and said, "I believe the world is coming to an end." The expert mountain climber had heard the rumbling and he knew what was happening. As the first rays of the morning sun came over the peaks from the east and touched the peaks to the west, the warm rays caused the ice to crack. The peaks would echo and re-echo that weird cracking sound, setting up a great reverberation. He patiently placed his strong hand on the arm of the young man and said, "Fear not, my friend, what you hear is not the *end* of the world, but the *dawn of a new day*."

Across the nation, both from within our profession and from without our profession, there are definite rumblings about the future of dentistry and orthodontics. There are those who are pessimistic and think that it is the end of the world for private practice and the existence of free enterprise, and there are those who are desperately striving to make it so. It could be, but it need not be. Of course, there are stupendous forces changing the world today. We in orthodontics must recognize them and prepare to meet them. We must not close our eyes in despair and wait for the end of our world but must open wide our eyes and go forth to greet the dawn of this new day, well prepared to face the challenge of this changing world.

It is, of course, needless to remind you that today we live in a changing world, for it was ever so. It is an established fact that nothing is constant in this world except change. Perhaps this is as God intended the world should be; He wanted before men at all times a challenge to their minds and souls and bodies that would fill them with "divine discontent," a challenge that would constantly drive them onward to greater accomplishments. It is these accomplishments that keep the world changing, and it is each new change that

is the challenge for another new and greater accomplishment. As we approach the dawn of a new intellect in this age of confused thinking, let us pray for Divine guidance and strength to face our problems intelligently and realistically with the courage never to compromise when it comes to upholding the principles and ideals that have made orthodontics a great and true profession.

It was said years ago that "these are the times that try men's souls." It could not have been more true then than it is today. It also has been aptly said that "to set the world right we must first, as individuals, set our hearts right." So, as we face these times that try men's souls, if we, as individuals, as dentists, and as orthodontists, will first set our hearts right, there is no challenge that we cannot meet, there is no problem that we cannot solve. However, if we divorce ourselves, either as individuals or as small groups, from what is best for our profession and the people we serve, we shall rapidly deteriorate into a trade or a craft and no longer be entitled to the honor of and recognition as a profession.

Some men think, "We live in a democracy and I have the right to do as I wish." No, my friends, a democracy does not give you the *right* to do as you wish but the *privilege* to do as you should.

Here I remind you of the meaning of the word *profession,* if not actually by definition, most certainly by precept and example. Through the years the term *profession* has come to be especially identified with the idea of service. This is an identification that should be deeply cherished by every member of a real profession. It suggests that a member of a profession serves, that he is imbued with the idea and ideal of service, that he measures his achievement in greatest part by what he has done for his fellow man and not alone by what he has done for himself. While a profession by no means prohibits one from accepting material rewards of the world, the person whose primary objective is material acquisition is not entitled to admission within the select company of those who possess and act in accordance with true professional philosophy—no matter what degree he may append to his name and no matter how prominent he may become in the public eye. To make an honest and honorable living is a worthy motive, but the supreme motive of a true profession is to contribute service to mankind. Let us not forget that "he profits most who serves best." We have a precious heritage embodied in this torch of service; be it yours to hold it high for all to see, appreciate, and respect. It will bring you rich rewards, and they will be rewards of the spirit which "rust doth not corrupt and thieves cannot break through and steal."

As a profession, our progress has been spectacular, partly as a result of a few great leaders, but much more so because we, the average individuals, have learned the wisdom, the importance, and the power of working together with a common purpose. Never forget, it is *you,* the individual, who is the basic element of our structure. When we think on the A.A.O. level, let us remember that the A.A.O. is but a composite of eight component societies. When we think at the component level, let us remember the component society is merely a group of individuals, just like you and me.

Isn't it strange that princes and kings,
And clowns that caper in sawdust rings,
And common folk like you and me
Are the builders of Eternity.

To each is given a bag of tools,
A shapeless mass and a book of rules,
And each must fashion ere life is flown
A stumbling block or a stepping stone.

*—R. L. Sharpe**

Just what are you doing daily with your professional life? Are you building stumbling blocks or steppingstones? That, my friends, is the main factor that will control the destiny of dentistry and orthodontics.

It appears that in all aspects of our modern civilization we have developed faster and further in our technology than we have in the realms of culture and social responsibility. The latter includes the problems of people living together and of persons with greater competence and means making it possible for the less fortunate to enjoy the ordinary benefits of modern civilization. Orthodontics, too, has developed in such a fashion. We have made outstanding technical advances; however, we have not made sufficient progress in terms of social responsibility to the public. We must never lose sight of the fact that the practice of dentistry is a privilege assured not solely by our education but also by state legislative action, and this can be taken away at any time the legislature is so inclined. Who influences the thinking of our legislators? Their constituents, of course, and these constituents are not just the good patients we serve well in our offices. These are in the minority. Their constituents are the masses of the people who may not be getting adequate dental care as private patients.

I need not remind you of the several years of legislative agitation through which we have recently passed, during which some form of compulsory national health insurance was considered with dental care as a part of the program. I personally doubt if the hour of decision is really completely passed. True, the present national administration has veered away from this trend, but there is nevertheless a continuing interest in the subject. The threat to the private enterprise system of health care is by no means significantly abated by a change in national administration, and we must remember that we have a potential change each four years. The promoters of national health insurance are still at work. In many ways, they have not changed. There is merely a lull at this moment. During this lull we, as one of the health service professions, must exercise our full energies toward the development of professionally administered programs of orthodontic care distribution to all segments of our population. If we fail, as an organization and as individuals to accept this responsibility, in future years we may have our priceless heritage taken from us.

The Public Health Committee of the A.A.O. is well aware of the fact that there is a segment of our population which we have not yet reached but to whom

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we have an obligation that we must assume. In cooperation with the Committee on Child Health of the American Public Health Association, they have prepared two excellent guides for a community program: "Dento-Facial Handicaps" and "Cleft Lip and Cleft Palate." Dr. J. A. Salzmann, as chairman of the Public Health Committee of the A.A.O., brought these guides to the A.A.O. when they were being prepared, and we had the opportunity to edit them. I recommend them to you. They should be in the library of every dental school, in the hands of the proper committee of every orthodontic organization, and, in fact, it would do us all a lot of good as individuals to study these guides. They not only make us more cognizant of problems that are our responsibility; they also impress upon us the fact that something needs to be done and will be done with these community programs. It behooves us to assume the leadership in these programs and thus be assured that they are properly organized, activated, and controlled. Yes, we have great responsibilities and opportunities in the field of public health. Herein lies one of our greatest challenges in this changing world.

We can be justly proud of our present-day scientific and technical status and the humanitarian benefits afforded by our profession. However, our pride must be tempered with humility, and we must have a sincere desire to better utilize our skills and knowledge in service to our fellow man. No matter how much knowledge or skill we possess, it is the *manner* in which we use it that is so important today. This is public relations, and public relations is another of our greatest challenges in this changing world.

There are many facets of public relations, and we cannot possibly cover all of them. I shall touch briefly on those I consider to be currently most important.

Let us remember that our public relations is by no means limited to our relationship with the lay public, our patients, and their parents. It also involves our relations with the practitioner of general dentistry and the other specialties of dentistry. It involves relations with the medical profession and other co-related health fields. Of course, a very important facet is our relationship with others in the profession of orthodontics.

In our relations with the general lay public we have a great responsibility. There are very few persons who enjoy more privileges in a community than an orthodontist. The more privileges one enjoys in a community, the greater becomes his responsibility to the community. Consequently, you should not wait to be asked but should go forth and seek ways that you may make contributions to your community. "He who waits until he is asked, has waited far too long." I am sure you will find that the public rarely begrudges a man personal success if he is appreciative and considerate of those to whom he owes his success. If you hope to enjoy real success, you must lend your abilities to the community that affords you that success. It is not enough to render a good professional service within your office; you must have an interest and take an active part in community civic affairs. As a professional man, you are considered by the people in your community as one who is capable of taking the initiative and leadership in health problems, particularly dental health problems. They look to you for leadership in projects to

aid underprivileged and handicapped children. Since your work is predominantly with children, you are considered a logical one to assist with many projects in your community for the benefit of all children. Of course, these are but a few examples of community activities that desperately need assistance which you are capable of giving. Remember also that one vitally important factor is the personal opinion your community has of you as a man, as a husband, and as a father. You are constantly on the spot; your every action is observed by someone in your community. Therefore, it is quite essential that you live your public life and private life in a manner that demands respect for you and your profession. Your public relations with the lay public should be patterned to be not just the most respected dentist or orthodontist but the most respected man in your community.

As practicing orthodontists and as respected citizens in our community, it is our responsibility to encourage and guide into our profession young men who manifest high professional potential. We must not sit idly by and let the increasing public need and demand for dentistry and orthodontics bring into our profession persons who do not possess the basic qualifications of true professional integrity. We are the ones responsible to our profession and to the public for the next generation of orthodontists. Let us fulfill this obligation with serious determination.

It is very important at this time that each of us create better relations with the parents of the children whom we serve daily. Although there are many important things to be considered, it is my belief that our relations with the parents of our child patients are determined mainly by three basic factors: (1) results obtained by treatment, (2) treatment time, and (3) fees.

Perhaps too frequently a parent is left with the impression that the final result obtained for the child will be perfect. Then, when the case is placed in retention and perfection has not been obtained, or when there is a slight relapse a few months after the completion of treatment, the parent is very unhappy. It has been my experience in dealing with the public that the quality admired most in a professional man is absolute sincerity. Patients do not expect you to be infallible. They do not expect you to know all there is to know about orthodontics. They come to you realizing that your work will perhaps have some limitations. Do not promise them results that are impossible or uncertain. Use absolute frankness and sincerity with each and every case, and the parents' attitude to orthodontics in general, and you in particular, will be most favorable.

We must be very cautious in estimating treatment time. It is my opinion that there is a dangerous trend in our profession to try to reduce treatment time below that which is in keeping with physiologic tolerance and due regard for the periodontal tissues. Let us keep in mind that, no matter what type of appliance provides the activating force, the rapidity of tooth movement should not exceed scientifically proved physiologic limits. I am sure that we will find most parents perfectly content with a conservative treatment time if they are made to understand the dangers of treatment that is too rapid. Here again, sincerity must prevail.

Perhaps the factor above all others that creates misunderstanding which results in criticism is that of fees. It is most difficult to discuss this problem, since it is a factor which, for obvious reasons, will vary greatly in different sections of the country and between individuals in the same section. Of course, we all realize that, in general, the public feels that fees for orthodontic service are too high. In some isolated cases this may be true. In the great majority of cases, however, it is not true. Personally, I believe that most orthodontic fees are justified, but we have failed in making the parent realize that they are justified. In my opinion, this is one of the greatest problems confronting the orthodontist today. From a public relations point of view, I would like to point out that while we have the right to charge any fee we desire, it is our basic obligation to make each and every parent or patient realize that the fee is justified and work out a method of payment that is agreeable and possible for him.

Perhaps our greatest public relations problem lies in our relationship with each other within our own profession. This is a touchy subject, but let's face it. Our greatest problem today among ourselves is criticism—criticism of another's appliance therapy, of his diagnosis and treatment planning, of his fees, to name a few. Now, I am not naive enough to think that we can all agree on one appliance therapy, one diagnostic procedure, or on treatment planning or fees. Nor do I think we should, for "when all men smile and agree, progress weeps." We should, in the proper place at the proper time, discuss freely our differences of opinion. Each man must have the privilege of his convictions and the courage to express them. Voltaire once aptly said, "I disapprove of what you say but I will defend to the death your right to say it." But, gentlemen, open criticism before our patients, the public, or other professional groups must stop. If ever we are tempted to criticize, let us remember that criticism hurts us who make it more than the one criticized, but it always hurts our profession generally. Our Code of Ethics states: "If there is indisputable evidence that a patient is suffering from previous faulty treatment or diagnosis, correct treatment should be instituted, doing it with as little comment as possible and in such a manner as to avoid reflection on the patient's previous orthodontist and on the profession." And, of course, in trying circumstances it always helps to remember, "Whatsoever ye would that men should do to you, do ye even so to them."

I regret that time does not permit further comment on some of our other problems. I have touched on only a few. However, I have tried to point out that the main problems confronting us today are basically the challenges of a changing world. We cannot see these problems through a mouth mirror, nor can we solve them in our offices alone. This age calls for constant *study,* for *vision,* for *courage,* and for *action* from each individual—from you and me, the builders of Eternity. Yes, there are rumblings in our respective towns and across the nation, but we will not consider it the end of our world. Individually, collectively, and under God's divine guidance, we must look to the east to greet the dawn of a new day.

THE MEANINGFUL INTERPRETATION OF GROWTH AND GROWTH DATA BY THE CLINICIAN

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THIS is the first of several articles which have as their ultimate purpose the integration of growth status data and their interpretation, roentgenographic cephalometric analyses, and certain treatment hypotheses and procedures. In the simplest possible terms our aim is to determine how growth status data, headfilm tracings, and models, *taken only once* (first examination), can be used orthodontically to serve as possible bases for treatment planning. In other words, we are trying to ascertain what the clinician can get out of dimensions, on both the living head and on tracings of headfilms, and models and their analytic interpretation.

There is a much larger issue at stake: How specifically referable are standards, norms, or mean values to individual case problems? In what precise detail can the clinician diagnose and plan as he uses (adapts) specific data within a norm framework? How does an individual case fit into the larger group picture of the total population from which the norms or means were derived? These questions pose the problem that each clinician must ultimately face: How rigid are the norms or standards? Or, to put it another way: What latitude may he permit the individual?

In a very provocative essay, Weiss[4] implores: "Let us not confound rule with fixity, order with rigor, regularity with stereotypism. Each individual is a unique form of expression of general norms and laws." As a result, organic order "sets only the general frame and pattern, leaving the precise ways of execution adjustable and, to this extent, indeterminate." What Weiss tells us is that "laws of development . . . prescribe only the mode of procedure," leaving "the actual execution free to adapt itself. . . ." Within the scope of this article, as well as of the others, all this means that norms, standards, mean values, analyses, etc. are more in the nature of guides than of directives. They may tell *what* is to be done; they may suggest *why* certain therapeutic procedures are indicated; rarely do they tell *how* correction is to be achieved. In a simple analogy, all the background data are similar to

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road maps—routes are shown, but it still takes an automobile to eat up the mileage. Substitute norms for the road map and technique for the vehicle, and you have the idea.

In this first article, I shall limit myself to certain basic growth data (at status level), using only information secured by a background study, plus certain body measurements (height and weight), plus detailed cephalometric measurements (on the head, that is, soft tissue measurements). I propose to evaluate the following data:

1. *General family background.* Ethnic origin of parents and grandparents. Siblings and birth order of the propositus.
2. *Family-line history.* A pedigree, gathered by questioning, of the dental-trait and occlusal history of both sides of the family.
3. *Health history.* A record of health vicissitudes, tonsillectomy and adenectomy, and allergic reactions.
4. *Oral habits history.* Recording of finger- and/or thumb-sucking, tongue-pushing, mouth breathing, lip- and nail-biting, pressure habits when asleep, etc.
5. *Dietetic history.* Eating habits and food intake as infant, young child, and juvenile.
6. *General growth.* Height and weight will be recorded and compared to age and sex peers, using the Gray and Ayres[2] standards as adapted at the Philadelphia Center for Research in Child Growth. The height and weight data will also be referred to the Wetzel Grid. The child's size growth will be compared to that of both parents. Using the Todd[3] standards for the hand, skeletal maturity will be assessed to relate biologic age to chronological age and to evaluate rate of progress toward maturity. A final appraisal of physical growth and maturational status will be given.
7. *Facial development.* A number of cephalofacial measurements are taken of heights, breadths, and depths. These are then plotted on the Philadelphia Standards, using mean value and plus or minus one standard deviation (M ± 1 S.D.). The resultant diagram will be analyzed in terms of plane of dimensional deviation (if such exists). The meaning of such a dimensional configuration will be presented.

As we work with facial development, we must accept and define two frames of reference: (1) occlusal classification and (2) stage of dental development.

The occlusal category to be used in this article is that of Angle, amplified by Dewey-Anderson:

Class I (Neutroclusion).—The mesiodistal relation of the mandibular arch to the maxillary arch as shown by the mesiobuccal cusp (triangular ridge) of the maxillary first molar fitting in the buccal groove of the mandibular first molar. There is malocclusion of the individual teeth.

Type I. Bunched or crowded incisors; the canines are frequently labial.

Type II. Protrusion or labioversion of the maxillary incisors.

Type III. One or more of the maxillary incisors in linguoversion to the mandibular incisors.

Type IV. Molars alone or molars and premolars in buccal or linguoversion.

Type V. Mesial drifting of molars resulting from premature loss of teeth.

Class II (Distoclusion).—Distal relation of the mandibular arch to the maxillary arch as shown by the relation of the mesiobuccal cusp (triangular ridge) of the maxillary first molar and the buccal groove of the mandibular first molar. The mesiobuccal cusp fits in the embrasure between the mandibular second premolar and the first permanent molar. The full distal relation is the width of a premolar or one-half the width of a molar.

Division 1. Protruding (labioversion) maxillary incisors, narrow maxillary arch, mouth breathing, frequently an underdeveloped mandible, abnormal muscular pressure, abnormal atmospheric pressure, mouth breathing.*

Subdivision. Unilateral, one side only is distal.

Division 2. Retruding or recessive maxillary incisors, the lateral incisors frequently labial, maxillary arch of good width, no mouth breathing, muscular pressure probably normal, atmospheric pressure probably normal, mandible usually well developed.

Subdivision. Unilateral, one side only is distal.

Class III (Mesioclusion).—Mesial relation of the mandibular arch to the maxillary as shown by the relation of the mesiobuccal cusp (triangular ridge) of the maxillary first molar and the buccal groove of the mandibular molar. The full mesioclusion is the width of one premolar or one-half the width of the molar; the mesiobuccal cusp of the maxillary first molar fits in the embrasure between the first and the second mandibular molars.

Type I. Maxillary and mandibular teeth in good alignment. Incisors in edge-to-edge bite.

Type II. Maxillary teeth in good alignment. Mandibular incisors lingual to maxillary incisors, crowded or bunched.

Type III. Maxillary teeth at times bunched; mandibular teeth in good alignment, but the mandibular incisors are labial to the maxillary incisors.

Division. Bilateral.

Subdivision. Unilateral, one side only is distal.

The stage of dental development is our adaptation and modification of Hellman's dental stage categories:

Stages II (Period of Late Infancy)

A. All deciduous second molars erupting or erupted, including 50 per cent eruption of all of them or 75 per cent of three of them.

V IV III II I I II III IV V
V IV III II I I II III IV V

*Practically the only factor initially taken into consideration is the interdigitation of the teeth. Later, all other factors are evaluated.

C. Beginning eruption of first permanent molars, including elimination of deciduous incisors and eruption of their permanent successors.

	V	IV	III		1		1		III	IV	V	
6	V	IV	III	2	1		1	2	III	IV	V	6

Stages III (Period of Childhood)

A. All first permanent molars erupting or erupted, including 50 per cent eruption of all of them of 75 per cent of three of them.

6	V	IV	III	2	1		1	2	III	IV	V	6
6	V	IV	III	2	1		1	2	III	IV	V	6

B. Elimination of deciduous canines and molars, and acquisition of their successors.

6	5	4		2	1		1	2	3	4	5	6
6	5	4	3	2	1		1	2	3	4		6

C. Beginning eruption of second permanent molars.

	6	5	4	3	2	1	1	2	3	4	5	6	
7	6	5	4	3	2	1	1	2	3	4	5	6	7

Stages IV (Period of Circumpubescence)

A. All permanent second molars erupting or erupted, including 50 per cent eruption of all of them or 75 per cent of three of them.

7	6	5	4	3	2	1	1	2	3	4	5	6	7
7	6	5	4	3	2	1	1	2	3	4	5	6	7

With the preliminary data in mind, we may now proceed to present the pertinent growth status data on each of five cases selected from the files of the Growth Center. Dr. Sassouni, in the following presentation, will use these same five as a nucleus, plus other cases from our files.

CASE 1.—Patient L. M., an American white boy born July 14, 1944, was seen on April 4, 1956, at the age of 11 years 9 months.

Fig. 14.—Lateral and facial views of Patient L. M.

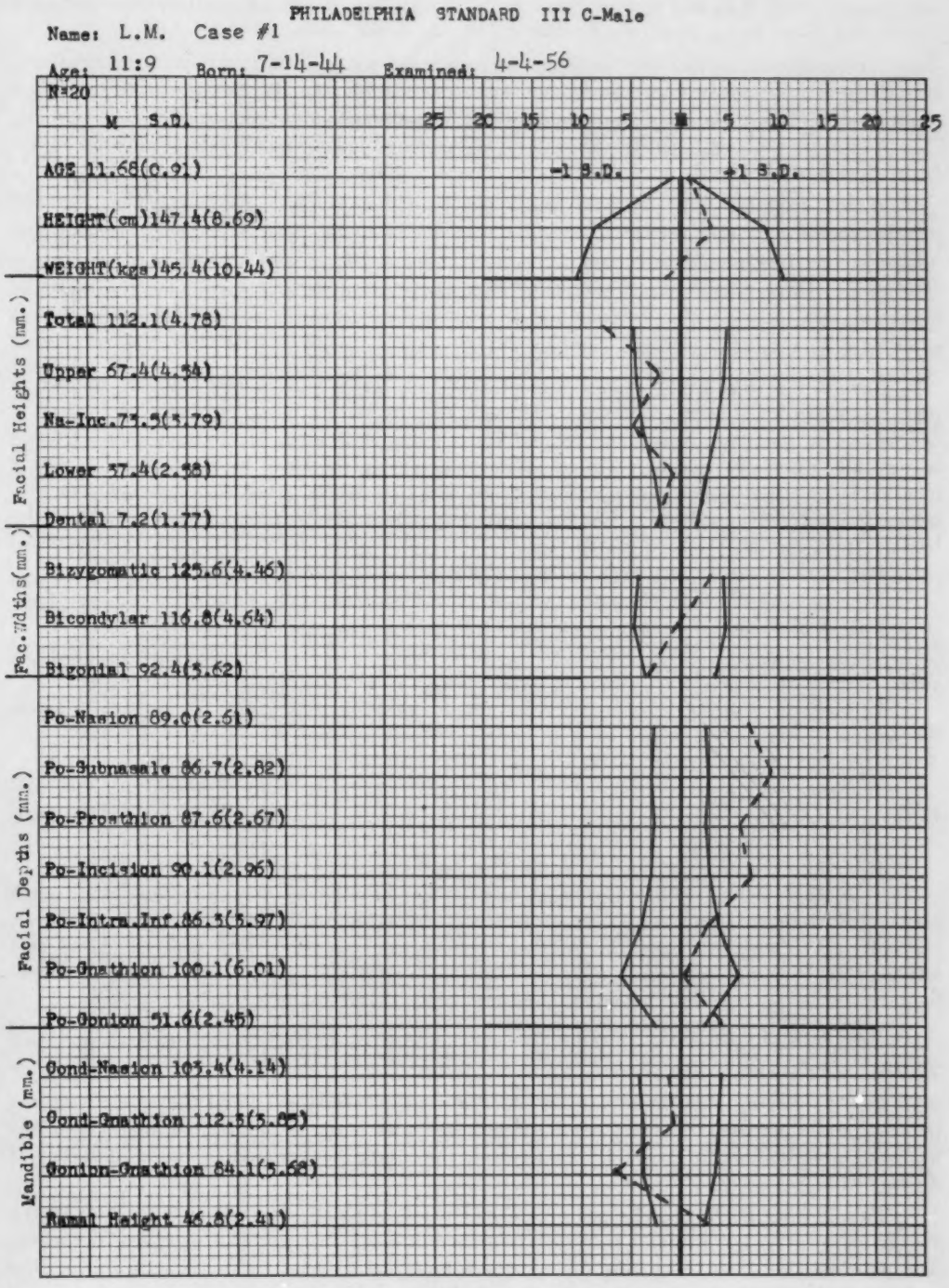


Fig. 1*B*.—Standard deviation diagram of Patient L. M.

General Family Background.—The boy's parents are of Italian origin. Both parents were born in the United States. The father's parents were born in Italy; the mother's father was born in Italy, but her mother was born in the United States. There are two siblings, a 13-year-old sister and a 2-year-old brother. The boy is the second of three children.

Family-Line History.—We could not secure a good pedigree on this boy. On the father's side there is a tendency to a small and retrusive mandible; on the mother's side there is a sister, one of twin girls, who has some crowding in the upper anterior teeth.

The most pertinent genetic possibility is the mandibular underdevelopment seen in the father's side of the family.

Health History.—The patient's health has been pretty good. He had chicken pox and measles at the age of 5 years and a slight attack of mumps (age not given). Tonsils and adenoids were removed when he was 6 years old. No allergies were disclosed.

Oral Habits History.—All we could find was "possible" tongue pushing, extent and duration not stated.

Dietetic History.—This boy has been a good eater all along.

General Growth.—At 11 years 9 months of age, he is 59.39 inches tall and weighs 95 pounds. When he is compared to the standards for 12-year-old boys, he is at plus ½ S.D. in weight and at the mean in height. On the Wetzel Grid he is in an M physique channel which is clinically rated as "good." On the percentile side of the Grid, he is advanced 1 year 7 months beyond the 67 per cent standard. The father is 6 feet tall and weighs 195 pounds; mother is 5 feet 5½ inches tall and weighs 180 pounds. The boy has a tall, heavy to stocky background.

His maturation age on the Todd Hand Standard is 12 years 3 months.

His physical growth and progress toward maturity have been very good.

Facial Development.—He has a Class II, Division 1 malocclusion.

On the Philadelphia Standards he is at dental stage III C with an average age of 11.68 years. He is, therefore, near the mean in eruptive age.

The standard deviation diagram shows a moderately high face with upper and lower heights in good balance.

The face is moderately broad.

The depth dimensions suggest an evenly retrusive face, accentuated by some midfacial prominence. Actually, face, as a whole, is forward in position, for all depth dimensions except porion to gnathion are well above the mean.

Mandibular dimensions reveal a short corpus, for gonion-gnathion is at minus 2 S.D.

This, it seems to me, is a case of discrepant maxillomandibular dimensions. With respect to mean values, mandibular corpus is short. Since ramal height is good, however, there is a tendency for this dimension to compensate for the corpal shortness. At this boy's age, there is some possibility of incremental growth in corpal length and in ramal height, which may aid in producing a more acceptable maxillomandibular alignment.

CASE 2.—Patient C. V., an American white boy born Oct. 27, 1947, was seen on April 23, 1957, at the age of 9½ years.

General Family Background.—The parents were born in the United States, as were the paternal grandparents. The maternal grandfather was born in the United States and the maternal grandmother in Ireland. In general, the ethnic background is Irish. The boy is an only child.

Family-Line History.—The pedigree shows possible genetic factors on both sides of the family. However, the father's side seems to show a more frequent and extensive deviation. The paternal line runs to narrow faces, with a tendency to small retrusive mandibles. The mother's side of the family runs more to round faces. The boy seems to follow the paternal line.

Health History.—The patient was a seven-month "preemie," weighing only 3 pounds 12 ounces. He was a breech presentation. He had a mild spastic cerebral palsy requiring

chronic hospital treatment for five or six years. He had chicken pox at 5 years of age; measles at 6. He is prone to bronchial infection. He gets colds very easily. Tonsils and adenoids were removed at the age of 4 years. All told, he has had rather a stormy health history.

Oral Habits History.—Until he was 9 years old, the patient was a mouth-breather and a lip-biter. Also, up to about this time there was hand or arm pressure under the face while sleeping (side of preference not ascertained).

Dietetic History.—The patient was a good eater as an infant and child, but is a choosy and erratic eater at present.

General Growth.—At 9½ years of age, he is 54.48 inches tall and weighs 51 pounds. When he is compared to the standards for 10-year-old boys, he is at minus 2 S.D. in weight and at minus ½ S.D. in height. He tends to be small and very slender. On the Wetzel Grid, he is in a B_s physique channel, which is excessively slender and clinically rated as "poor." On the percentile side of the Grid he is retarded 1:6 compared to the 67 per cent standard. The father is 6 feet tall and weighs 186 pounds; the mother is 5 feet, 6 inches tall and weighs 116 pounds. The patient's slenderness may be from the mother, but also it may be the result of his rather poor health history.

His maturation age on the Todd Hand Standards is 10:9. Here he is moving quite well.

Fig. 24.—Lateral and facial views of Patient C. V.

This is an interesting contrast between rather poor physical growth and rather good progress in maturation. I am inclined to weight the latter a bit more strongly and, therefore, to conclude that his growth is acceptable.

Facial Development.—He has a Class II, Division 1 malocclusion.

On the Philadelphia Standards he is at dental stage III B with a mean age of 10.19 years. He is advanced about 0:6 in eruptive age.

His cephalometric measurements on the standard deviation diagram show considerable imbalance. The height dimensions, for example, show a rather low total facial height and, within that, a large upper face compared to a small lower face.

Breadth dimensions show a rather narrow midfacial breadth.

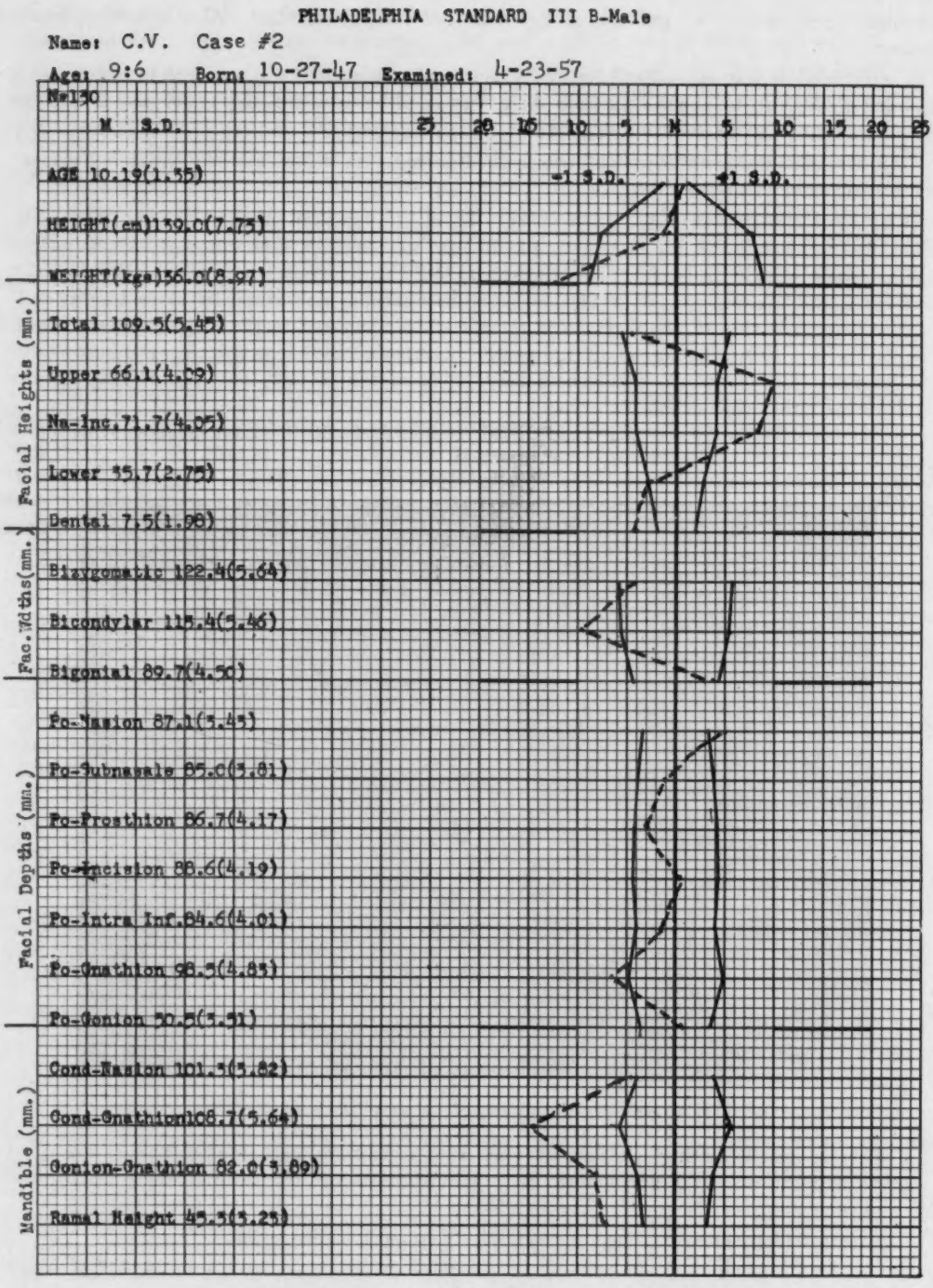
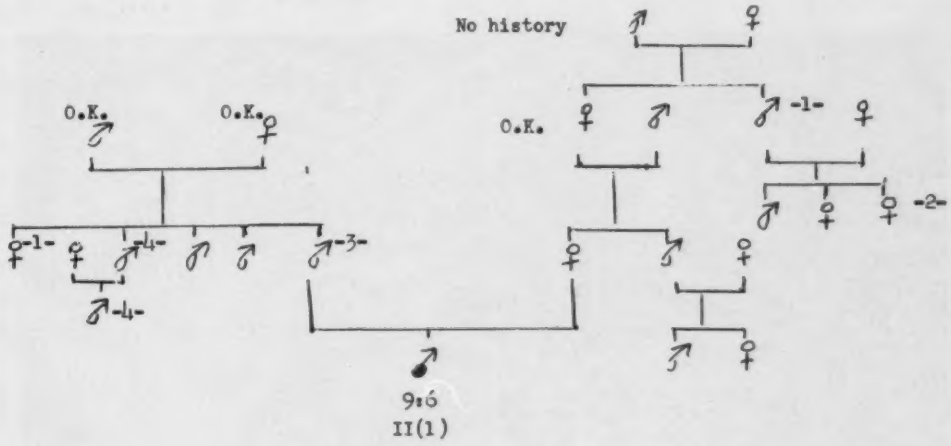


Fig. 2*B*.—Standard deviation diagram of Patient C. V.

The depth dimensions show a rather markedly retrognathous face. Facial depths, as a whole, cluster around the mean, but porion to gnathion is well below minus 1 S.D.

Mandibular measurements emphasize shortness of corpus and of ramus.

This, I think, is a very serious problem. First of all, there is a history, on the father's side, of small mandibles. Second, this child shows additional dimensional failure which I feel to be a true growth deviation. It may be that there will be some incremental growth in corpus and in ramus in a couple of years, but I do not think that this will help much. Essentially, even when maxillo-incisal prominence is corrected, he will still have a retrusive lower face. Orthodontic treatment may improve this boy's dentition, but it will not change his face markedly.



1. Upper I1-I1 very protrusive.
2. These three had "very large" upper centrals.
3. All incisors, upper and lower, very large, with crowding, especially in upper anteriors.
4. Crowded upper and lower anteriors.

Fig. 2*C*.—Occlusal history of Patient C. V.

CASE 3.—Patient R. M., an American white boy born June 16, 1942, was seen on Sept. 27, 1956, when he was 14 years 3 months of age.

General Family Background.—His parents and all of his grandparents were born in the United States of English and Scotch background. The boy, the second of two children, has a sister a little over 15 years old.

Family-Line History.—As can be seen in the pedigree, there is crowding of teeth on both sides of the family, plus supernumerary canines on the maternal side. It is to be noted that the maternal grandfather married twice and that both wives had protruding upper anterior teeth and crowded lower teeth (in the chart, I have not been able to differentiate the precise allocation of the offspring of this double marriage). There is every reason to believe that the boy has inherited certain dental traits predisposing to malocclusion.

Health History.—He has had excellent health throughout. He had chicken pox and measles at 5 years of age. Tonsils and adenoids have not been removed. No allergies are present.

Oral Habits History.—This is completely negative.

Dietetic History.—There are no significant factors here. He is said now to be a very light eater, but he has a well-balanced diet.

General Growth.—At the age of 14 years 3 months he is 61.69 inches tall and weighs 85 pounds. When these measurements are compared to the standards for 14-year-old boys, he is seen to be at minus 1¼ S.D. in weight and at minus ¾ S.D. in height. This means that he tends to be small for his age and relatively slender. This is confirmed by the Wetzel Grid; he is in a B_3 physique channel, which is clinically rated as "borderline" and suggests that he is very slender. On the Grid, on a percentile rank basis, he is 1:6 behind the 67 per cent standard. The father is 5 feet 7 inhces tall and weighs 140 pounds. The mother is 5 feet 2 inches tall and weighs 120 pounds. The boy's small size is probably familial.

Fig. 3*A*.—Lateral and facial views of Patient R. M.

His maturation age on the Todd Hand Standard gives an over-all rating of 13 years 9 months.

In general physical growth and in progress toward maturity, this boy is doing well.

Facial Development.—He has a Class II, Division 1 malocclusion.

He is in dental stage III C which, on the Philadelphia Standards, gives an average age of 11.68 years. He is, therefore, retarded about two and one-half years in eruptive age.

The standard deviation diagram shows a moderately high face with upper and lower heights in fairly good proportion. Dental height is below minus 1 S.D., which suggests considerable overbite.

Breadths are moderate, with bicondylar breadth relatively small.

The depth dimensions suggest maxillo-incisal prominence with a relative mandibular retrusion.

Measurements on the mandible show no dimensional imbalance.

Attention should be called to porion-gonion and ramal height, both of which are above plus 1 S.D. These are, in a sense, measurements of posterior facial height. They should be compared to lower (anterior) facial height, which is really mandibular symphysial height.

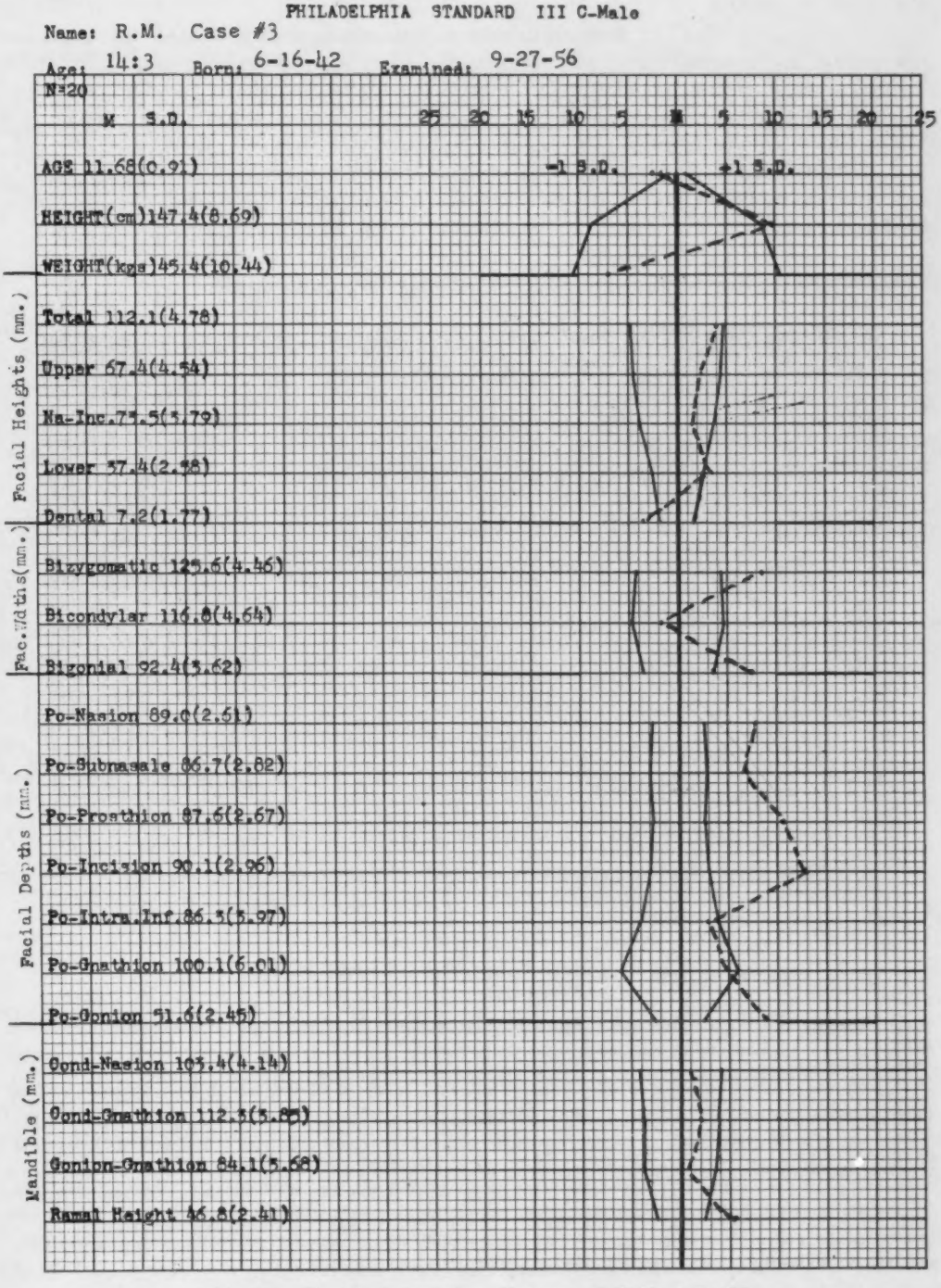
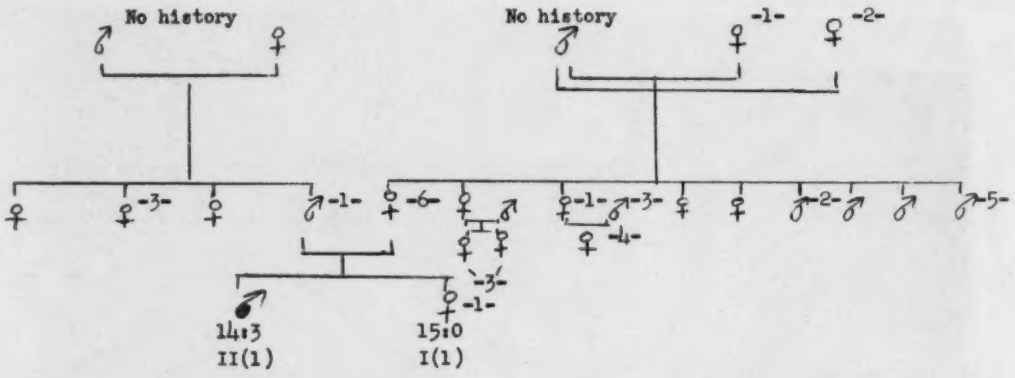


Fig. 3*B*.—Standard deviation diagram of Patient R. M.

This, too, is above plus 1 S.D., although not markedly so. These dimensions suggest that symphysial height and ramal height are in good balance and that, therefore, mandibular slope should not be marked.

An evaluation of all of these cephalometric measurements suggests that the basic problem centers in the midsagittal plane and that the midface is primarily involved. By this I mean that maxillo-incisal prominence is the main factor, for mandibular size and proportions are quite acceptable. This suggests to me that treatment must center around driving the upper anterior teeth back.

Since this boy is 14 years 3 months of age and his bone age is 13 years 9 months, I do not expect any further growth in the mandible. Therefore, this is almost 100 per cent a treatment case.



1. Protruding upper I 1-2, crowded lower anteriors; extracted upper R canine in palate, transversely directed, receiving orthodontic care.
2. Crowded lower anteriors.
3. Protruding upper I1-I1.
4. Protruding upper I 1-2, plus extra upper R canine.
5. Extra upper R canine.
6. Upper R canine buccal in position.

Fig. 3*C*.—Occlusal history of Patient R. M.

CASE 4.—E. Z., an American white boy born April 15, 1942, was seen on May 16, 1956, when he was 14 years 1 month of age.

General Family Background.—The father and mother were born in the United States. The father's parents were born in Poland; the mother's father was born in Poland and her mother in the United States. The boy is the third of four children. He has a 9-year-old brother and sisters aged 21 and 22 years.

Family-Line History.—The pedigree, which is not very complete, shows nothing in the father's line (all are in Poland, so data are inadequate). A sister shows a habit effect (?), and the mother shows some malalignment of the upper anterior teeth. There is no history of a Class III tendency.

Health History.—The boy had chicken pox at 3, measles at 7 and mumps at 9 years of age. His tonsils and adenoids have not been removed. There are no allergies. Health is very good.

Oral Habits History.—A pacifier was used for two months, between the ages of 9 and 11 months. "For some time," while reading, he has been in the habit of "resting his mouth and chin on his fist."

Dietetic History.—He has been a very good eater all along.

General Growth.—At 14 years 1 month of age he is 64.1 inches tall and weighs 107½ pounds. When he is compared to the standards for 14-year-old boys, he is just below the mean in both height and weight. On the Wetzel Grid he is in a B_1 physique channel, which is clinically rated as "good." On the percentile side of the Grid he is 0:3 above the 67 per cent standard. The father is 5 feet 10 inches tall and weighs 190 pounds; the mother is 5 feet 5½ inches tall and weighs 192 pounds.

On the Todd Hand Standards the boy has a maturation age of 13 years 3 months, which is a bit slow but not significantly so.

All in all, general growth and rate of progress toward maturity are very satisfactory.

Fig. 4*A*.—Lateral and facial views of Patient E. Z.

Facial Development.—He has a Class III malocclusion.

On the Philadelphia Standards his dental stage is IV A, with an average age of 12.64 years. He is, therefore, a little over a year "retarded" in eruptive age.

The standard deviation diagram shows most facial dimensions to be in pretty good balance. While total facial height is a bit low, upper and lower face heights are proportionate.

Breadths are moderately narrow.

The depth dimensions show the midface to be evenly a bit above the mean. The lower face (mandible) is relatively and absolutely protrusive, although intradentale inferius is more prominent than gnathion.

The mandibular dimensions show a relative prominence of the chin (cond-gn), even though corpal length (go-gn) is near the mean. Ramal height is near plus 2 S.D., and it is this, rather than corpal length, that has pushed chin (and corpus generally) forward.

In a sense, this case points to a weakness in dimensionality only. There is an evident Class III dental malocclusion borne out in part by lower face depth dimensions which are above plus 1 S.D., and yet corpal length (go-gn) is a bit below the mean. How is this to be

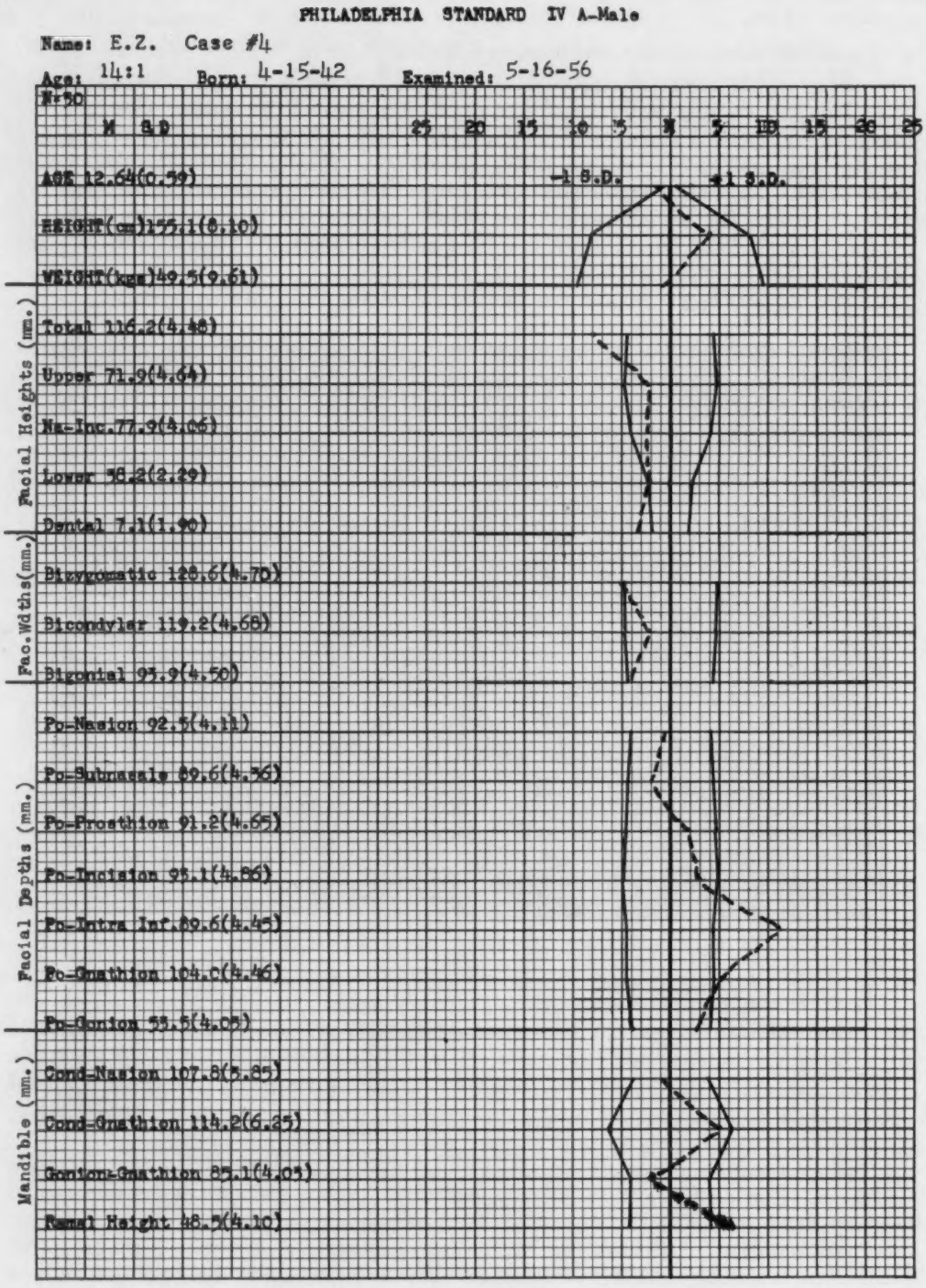


Fig. 4*B*.—Standard deviation diagram of Patient E. Z.

accounted for, dimensionally? In part, I think, by one dimension that I have already noted, that is, a high ramal height. But this is not enough; if it were accompanied by a wide-open gonial angle then lower face (chin) might be correspondingly affected. Here, then, we must look to roentgenographic cephalometry for angular relationships and for the spatial relationship of contiguous bony segments or structural units.

CASE 5.—R. B., an American Negro boy born Sept. 8, 1943, was seen on April 17, 1956, at the age of 12 years 7 months.

General Family Background.—The boy is the only son of American Negro parents. There is some evidence of white admixture, but when this occurred and its extent are not known.

Family-Line History.—We could not secure a complete family history. There is reason to feel that malocclusion, due to crowded anterior teeth, runs in the maternal line, but specific evidence is not forthcoming.

Health History.—He has enjoyed excellent health. He had measles at the age of 9 years. Tonsils and adenoids were removed when he was 10 years old. The only allergic reaction is to the eating of chocolate.

Oral Habits History.—He sucked the right index finger and thumb day and night up to the age of 5, and mostly at night only until he was 7 years of age. He was a marked mouth-breather until his tonsils and adenoids were removed and still breathes through his mouth when sleeping.

Dietetic History.—He was said to have been a very poor eater as an infant and as a younger child, but is "a little better" now.

General Growth.—At the age of 12 years 7 months he is 58.66 inches tall and weighs 80 pounds. When he is compared to standards for 13-year-old white boys, he is at minus 1 S.D. in both height and weight. He tends to be rather small and a little bit on the slender side. On the Wetzel Grid he is in a B_2 physique channel, which is clinically rated as "fair," that is, he is slender. On the percentile side of the Grid he is only 0:5 behind the 67 per cent standard. The father is 5 feet 9½ inches tall and weighs 150 pounds; the mother is 5 feet 2 inches tall and weighs 125 pounds.

The boy's maturation age on the Todd Hand Standard for white boys gives an over-all age of 12 years 3 months.

In general physical growth and in progress toward maturity he is doing satisfactorily.

Facial Development.—He has a Class I, Types 1 and 2, malocclusion.

His dental stage on the Philadelphia Standards is III B with an average age of 10.19 years. He is, therefore, retarded about two and one-half years in eruptive age.

The height dimensions show nothing significant. He has a high face with upper and lower heights in good balance.

Breadths show nothing. The face is moderately broad.

The depth dimensions show a face which is very prominent maxillo-incisally, the prominence being both absolute and relative since the chin point is at the mean and is relatively retruded.

The mandibular measurements show nothing unusual. Corpal length from gonion to gnathion is at the mean.

It should be noted that ramal height is above plus 1 S.D. while lower facial height (symphysial) is at nearly plus 3 S.D. This suggests that anterior lower facial height and ramal height are a bit out of balance, conducing to mandibular slope.

There is marked bimaxillary fullness in this case, as is seen in the dimensions porion-to-incision and porion-to-intradentale inferius; it will be noted that porion-to-incision is even more prominent due to incisal procumbency.

The problem in this case, cephalometrically considered, revolves around maxillo-incisal prominence and the need for its reduction. A good deal of the bimaxillary fullness in this boy is racial, linked to the genetic alveolar prognathism of the Negro. Realignment

of the maxillary incisors and pushing back of the upper anterior teeth must not go beyond the bounds of genetically entrenched bimaxillary prominence. White standards, either cephalometric or roentgenographic, must be used very cautiously in order not to attempt a restriction incompatible with the genetic pattern of a Negro face.

Fig. 5A.—Lateral and facial views of Patient R. B.

DISCUSSION

The pertinent question is simply this: What do the growth status data in the foregoing cases tell the clinician, diagnostically or prognostically? Are they really conducive to a better understanding of the case of malocclusion in a larger organic (biologic) context? To answer these questions, I propose to see how the background and growth data shape up on a comparative basis. To do this, I shall synthesize each item in the series.

General Family Background.—In Case 1 Patient L. M. is of Italian origin. In Case 2 Patient C. V. is of Irish origin. In Case 3 Patient R. M. is of English-Scotch origin. In Case 4 Patient E. Z. is of Polish origin. In Case 5 Patient R. B. is an American Negro.

This information throws light on general facial configuration, an ethnic incorporation, as it were, into a family-line transmission. L. M. in Case 1 is likely to have a more slender, gracile-bone facial skeleton, with rounded oval contours. The boys described in Cases 2 and 3 are likely to have a more rugged, massive facial skeleton, with squared contours. E. Z. in Case 4 is likely to have a moderately rugged facial skeleton, with flattened malar planes and prominent zygomatic arches. R. B. in Case 5 will show prognathism, both maxillo-alveolar and mandibular. Facial skeleton may be expected to be moderately slender.

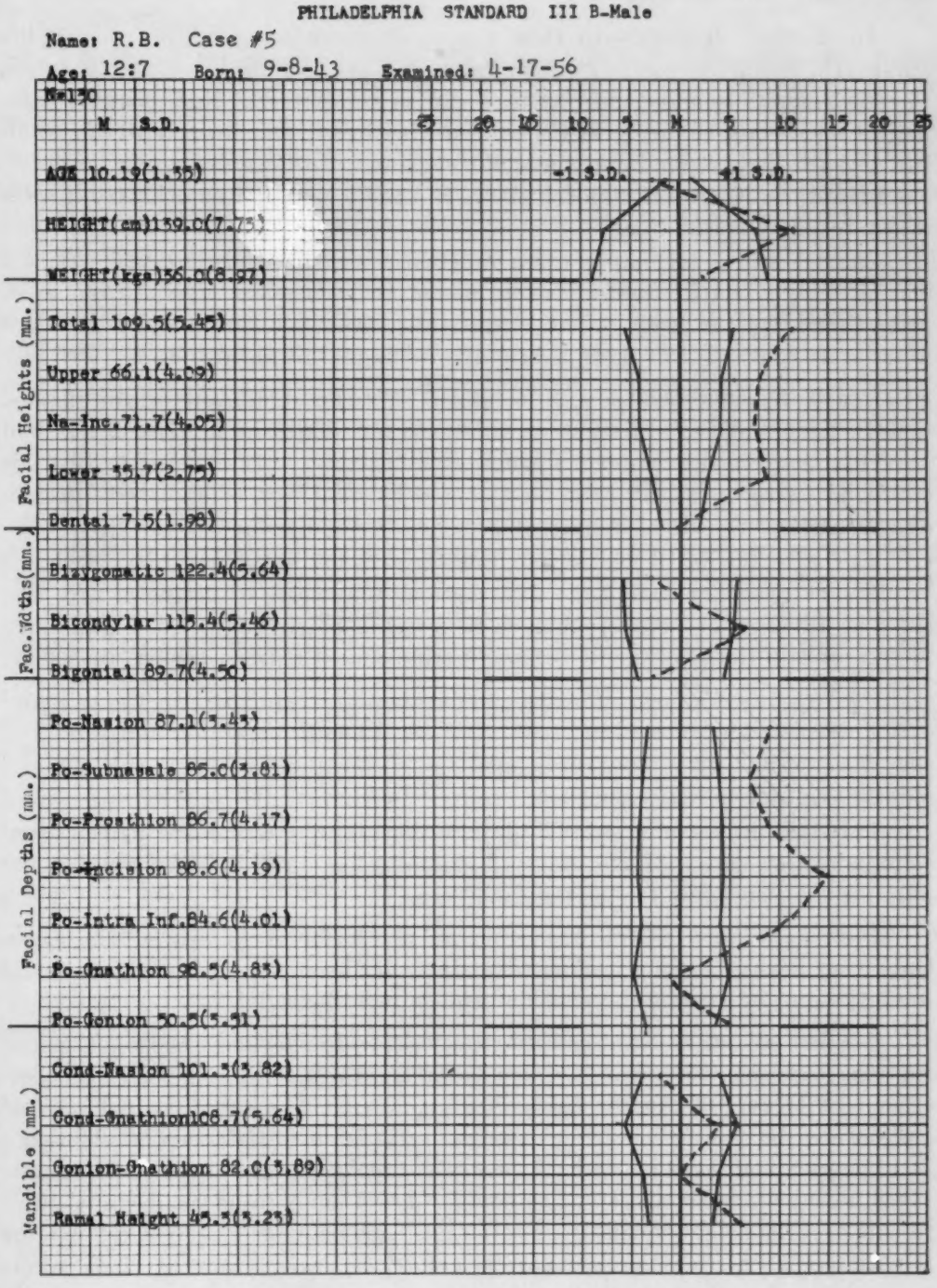


Fig. 5*B*.—Standard deviation diagram of Patient R. B.

All told, these ethnic data aid in giving some idea of facial pattern, both structurally and esthetically.

Family-Line History.—In Case 1 a small, retruded mandible runs in the paternal line; this is possibly etiological in a Class II face. In Case 2 a small, retruded mandible and a narrow face run in the paternal line, possibly etiological in a Class II face. In Case 3 crowded upper and lower anterior teeth run in both the paternal and the maternal lines. In Case 4 there is no previous record of a Class III malocclusion. In Case 5 crowded anterior teeth seem to run in the maternal line.

Cases 1 and 2 seem to show a *repetitive trait* transmission, while Case 4 and possibly Case 5 show a *discontinuous* or *assortative trait* transmission. (See Asbell,[1] pp. 282-283.) The boy in Case 2 shows by far the most evident inheritance of small-jawedness, almost of a micrognathic nature.

Health History.—Cases 1, 3, 4, and 5 show no significant health factors, that is, none sufficient to stunt growth pattern. The boy in Case 2 has had a very stormy health history, including prematurity. It is possible that his midfacial narrowness may have been caused by inhibition of transverse growth dimensions in the years of infancy and very early childhood.

As a rule, the health vicissitude, to be growth-inhibiting, must be very acute or chronically severe during the first three or four years of postnatal life. Insults or illnesses of neurotrophic or neurogenic origin may prove inhibitory factors at any time during the growth period—more marked earlier, of course.

Oral Habits History.—Possible factors here are equivocal in Cases 1 and 4 and completely negative in Case 3. In Case 2 mouth breathing and lip-biting are in evidence. In Case 5 prolonged thumb-sucking and finger-sucking and mouth breathing may be etiological.

This still leaves unanswered the question as to whether the habits listed were causes or effects of the observed malocclusion. The boy in Case 5 is the only possible candidate for the tag "habit case."

Dietetic History.—Diet was probably not a factor in any of the cases. Only very severe and/or prolonged undernourishment or malnutrition would inhibit, stunt, or deviate the cephalofacial growth potential.

General Growth.—The boy in Case 1 is large for his age; his height-weight ratio is good; skeletal age of 12 years 3 months is within ± 1 year of chronological age of 11 years 9 months (it is plus 6 months). The boy in Case 2 is small and slender for his age; his height-weight ratio is not satisfactory; skeletal age of 10 years 9 months is beyond ± 1 year of chronological age of 9 years 6 months (it is plus 1 year 3 months). The boy in Case 3 tends to be small and slender for his age; his height-weight ratio is not good; skeletal age of 13 years 9 months is within ± 1 year of his chronological age of 14 years 3 months (it is minus 6 months). The boy in Case 4 is at the lower end of the normal range of variation in height and weight (for age), but the height-weight ratio is good; skeletal age of 13 years 3 months is within ± 1 year of chronological age of 14 years 1 month (it is minus 10 months). The boy in Case 5 tends to be small and

slender for his age; his height-weight ratio is acceptable; skeletal age of 12 years 3 months is within ± 1 year of chronological age of 12 years 7 months (it is minus 4 months).

These data throw some light on the general over-all physical growth status (as seen in height and weight). Most important, however, they tell much of potential growth timing: the boy in Case 1 may expect his prepubertal growth acceleration soon; the boy in Case 2 will get it sooner than his chronological age suggests, for his maturation rate is accelerated; the boys in Cases 3 and 4 can no longer expect or receive any growth acceleration; the boy in Case 5 is in his, or soon will be.

To recapitulate, growth may be a potential treatment adjunct (as it may affect incremental growth in corpus, ramus, and anterior vertical dimensions) in Cases 1, 2, and 5; there is no such promise is Cases 3 and 4.

Facial Development.—In Case 1 there is probably a growth deviation (short corpus) which has produced a disharmonic maxillomandibular mesiodistal relationship. In Case 2 there is a combination of both hereditary and growth dysplasia verging upon a micromandibular condition. In Case 3 there is no real growth disharmony. The cause of maxillo-incisal prominence is obscure; it is not habit; it may be an hereditary reflection. In Case 4 there seems to be some ramal overgrowth (disharmonic with corpal length and lower facial height, or symphysial height); to this must be added the patterning of an "open" gonial angle. In Case 5 there are certainly genetic factors (racial), possibly coupled with habit factors.

Taking all growth status evidence into consideration, I venture prognosis as follows:

Case 1—Favorable
Case 2—Poor
Case 3—Good
Case 4—Doubtful
Case 5—Good.

EVALUATION

One swallow does not make a summer, and five case histories, however carefully derived and cautiously interpreted, do little more than throw a bit of light on a single child. Now let us see if we can answer some questions which will make the case history approach generally applicable and meaningful.

1. *What of the Family?* What good does it really do to delve into family background? I think that the histories presented show one thing certainly: there are racial (in part ethnic) differences in general growth and in faciodental growth patterns. If we adopt the "whole child" approach in an orthodontic case—if we want to learn of general systemic growth—then we must make allowances, in a given case, for deviation from a norm caused by racial or ethnic differences. To be "too short" is not necessarily a sign of

growth retardation; to be "too tall" need not involve a hyperendocrine situation. The shortness or tallness is most frequently relative rather than absolute, that is, it is due to racial or ethnic inheritance rather than being a significant biologic deviation. In like manner, and even more vigorously true, a malocclusion in a Negro child should be judged if not first racially, at least with equal prominence, along with clinical evaluation. To know the parents well is to know the child (as a patient) better.

2. *What of Heredity?* Can we work with genetics, that is, put it to work in our favor? Unfortunately, the answer must be only partially affirmative. We can look at genetic knowledge from two approaches: (1) anticipatory and (2) prognostic. The first approach might well run something like this: Our family-line study seems to suggest that there may be a possible structural clash between tooth and bone (large teeth of the one parent and small jaws or arches of the other). With this in mind, the deciduous teeth and arches can be closely followed into the permanent dentition for incipient tooth-bone malalignments (crowding, rotation, etc.) which can be caught and corrected as soon as signs are apparent. This can well be worked into concepts of "preventive orthodontics." The second approach can be a very important one in thinking in an individual case. If there is good reason to assume that a malocclusion has a genetic foundation, then ultraconservatism is necessary when either estimating or appraising a "finished" case. Why? Because a basic genetic etiology probably will not involve tooth and bone alone; there will be a balanced complex, so to speak, involving muscle physiology as well. If this type of argument is followed to its logical conclusion, we may say something like this: In such cases relapse—or better, reversion—is more likely to occur by way of an attempt to achieve the status quo of the before-treatment interference than it is in cases of nongenetic (traumatic and/or habitual) origin. Here we are suggesting that "failures," in whole or in part, may be traceable to the relative inborn stubbornness of a genetic complex.

3. *What of Oral Habits?* I must confess to being ambivalent on this question. Some years ago I went over our Growth Center files, listing samples by occlusal categories and by oral habits history data (thumb- and finger-sucking, lip-biting, tongue-thrust, etc.). I found, via tabular inspection, such variable combinations between normal occlusion, malocclusion, absence of habits, and presence of habits that I am ready to conclude that oral habits can be overrated as causative factors. If there is a predisposition to dentofacial dysplasia, then bad habits can make a bad matter worse. They have to be pretty severe and prolonged to distort an otherwise acceptable dentofacial complex.

4. *What of Food and Diet?* I am just about ready to drop this item from the case history inventory. There is evidence to suggest that severe undernourishment or malnutrition in the first three years of life may permanently stunt growth, including facial growth. After this, however, the underfeeding

would have to be inordinately severe to register in terms of serious deviation in bone growth inhibition and dysplasia. Or, perhaps, our techniques are too gross to pick up the *real* clinical effects in terms of damage at the cellular level. Be all this as it may, a dietetic record for older children is not very helpful in an orthodontic case.

5. *What of Physical Growth?* Here is where we strike pay dirt! A combination of body measurements, especially height and weight, plus roentgenograms of the hand, followed progressively (serially), will provide an understanding of growth timing which can be fitted into the thinking of the possible utilization of growth (increase in size) in treatment.

Children do not all grow at the same time; nor do they grow at the same rates over the years. There are "slow growers," there are "fast growers," and there are those in between. Further, there are times, in the growth of all children, of accelerated and decelerated *rates*. Finally, there are "late maturers," "early maturers," and those in between. How can we use these ideas?

(1) The slow growers will unfold more gradually; they are, for example, smaller, age for age, than their age and sex peers. This is their inherited potential. They will have to be watched a bit longer before they move into periods of faster growth. In a sense, slow and fast growers are below and above averages or mean values, respectively.

(2) There are, in every child, periods of fast growth and of slow growth which are quite normal. For example, growth is pretty rapid from birth to about 5 years of age (especially in the first year); it slows down from 5 to about 10 or 11; then it speeds up to about 15 or so; then it gradualy tapers off. It is important to keep track of this interplay of fast-slow-fast-slow. One speed-up is very important—when the child begins his prepubertal statural acceleration it may be accepted and expected that in nine months to a year *later* the facial skeleton will also show a speed-up (corpal length and ramal height of the mandible are dimensions in point).

(3) The *real* age for growth timing is biologic and not chronological. The child grows by his own time schedule, not by the calendar, even though *most of our standards a*re based on cultural units (years and months) rather than on biologic time. The roentgenograms of the hand give us a way to see how the child's own chronometer is ticking off the moments of growth. One will watch with different eyes and interpret with different thinking a child whose biologic age is retarded or accelerated, that it, respectively, more than a year behind or more than a year advanced in skeletal age compared to chronological age. There is reason to believe that a higher rate of malocclusion and more severe cases (the Class II, Division 1 cases, for example) are to be found in maturational laggards.

6. *What of Facial Development?* Obviously here I shall discuss only cephalometry, as the contribution of roentgenographic cephalometry is not within the scope of my present appraisal.

Right at the start let me admit an immediate limitation: since dental occlusion and facial structure (configuration) are not always directly correlated, cephalometric dimensions cannot always be related to kind or degree of malocclusion. In other words, a "normal" occlusion and a "normal" (or symmetrical) face do not necessarily go together, or vice versa.

This admission is, fortunately, only partly true. The cephalometric measurements taken in the midsagittal plane—the *depth* dimensions—may not only be a reflection of mesiodistal relations in the teeth, but they are definitely related to all mesiodistal measurements taken on tracings of the lateral x-ray films. So definite am I in my thinking along this line that I regard a Class II, Division 1 and a Class III malocclusion as the only ones that may frequently be demonstrated by cephalometric dimensions as revealed in an S.D. diagram. This is because these classes of malocclusion are often indicative of a growth dysplasia. In a Class I and a Class II, Division 2 malocclusion, cephalometry can only affirm what the clinician has already seen in making his diagnosis.

I end my final evaluation on the role of growth analysis in orthodontics by saying that it yields valuable background understanding of the patient. It yields a certain amount of more precise knowledge concerning face and teeth. And from there on? Well, the torch of information must then be passed on to the roentgenographic cephalometrician. Here all that we have learned of the child comes into the sharp focus of a relatively precise technique.

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DIAGNOSIS AND TREATMENT PLANNING VIA ROENTGENOGRAPHIC CEPHALOMETRY

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WITH the constant desire to improve the results of orthodontic treatment, the study of the patient becomes more minute every day. Orthodontic files become more and more voluminous; records of the direct examination, past history, present status, physical appraisal, family-line history, photography, dental models, full-mouth, lateral-jaw, condylar, and cephalometric roenogenograms, growth charts, etc., taken at regular intervals, provide better tools for the static analysis of a case and for the study of its progress.

Once the pertinent information and records have been gathered, however, their interpretation and application in individual cases present one of the most important problems. Dr. W. M. Krogman has applied the meaningful interpretation of growth and growth data. I shall focus my presentation on the importance and use of roentgenographic cephalometry as a tool of diagnosis and treatment planning.

In a first section of this article I shall describe a three-dimensional analysis and the norms that guide one toward an optimum treatment of each individual case. In a second section the actions and limitations of orthodontic therapy will be critically reviewed. In a third section a synthesis between diagnosis and treatment will be made and applied to five cases.

PART I. ROENTGENOGRAPHIC CEPHALOMETRIC ANALYSIS

At the outset it should be made clear that if roentgenographic cephalometry is given the spotlight, in this presentation, it does not mean that this is the only and all-inclusive medium of case analysis. All other records and information have their place. I wish to show here what the clinician can obtain from the cephalometric x-ray that he cannot obtain (as easily and as accurately, if at all) from other records.

Roentgenographic cephalometry gives an inside picture of the cephalofacial architecture: the cranial base, its bending, and its influence;[3, 16, 24] the palatal plane, its size and slope, and its influence on malocclusion;[20, 24, 25, 27] the

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occlusal and mandibular planes and their relationship with the two previous planes;[3, 8, 10(a), 10(b), 14, 19, 22, 24, 30, 31] the axial inclination of the teeth, their path of succession and eruption[7]; and the breadths of the upper and middle face, of the nasal cavity, or the maxilla.[13, 25, 29] More than individual bone or segment of the face, however, roentgenographic cephalometry gives a total three-dimensional view of the face and the integration of the dental apparatus in the skeletal frame.[6, 12, 25]

As for the way the clinician can use the findings from the films, there are parts of the face beyond the reach of orthodontic therapy. For example, a wide cranial base angle cannot be changed. However, the value of its assessment is of importance for a better knowledge of the etiology of that particular malocclusion. At the same time, the assessment of these parts has a prognostic value: it sets limits within which corrections can be achieved, and it gives warnings for or against excessive confidence.

In other cases roentgenographic cephalometry will pinpoint a given dysplasia. It might not tell exactly what to do, but at least it will warn against the use of certain types of treatment and, by elimination, suggest the most appropriate. For example, when a patient presents a large palatomandibular angle, a large lower face height, and a lack of chin button, the use of Class II elastics has to be avoided (unless a perfectly stable anteroposterior and vertical molar anchorage can be secured).

In other cases roentgenographic cephalometry gives more decisive reasons for certain types and directions of treatment. For example, in a case with a maxillary dental arch protrusion and a well-positioned mandible and mandibular arch, preference should be given to a treatment based on cervical traction of the maxillary arch, without touching the mandible.

Through these few examples it becomes obvious that the cephalometric x-ray picture should be assessed by careful measurements. This evaluation is done via an analysis. There are proposed in the literature some forty different types of analysis that I have critically evaluated in the *Syllabus in Roentgenographic Cephalometry*.[17] One of the most important findings arising from a comparison of the different analyses was that those analyses based on a single plane of reference (for instance, nasion-sella or the Frankfort horizontal) are unreliable because these particular planes have a different slope in different persons. Another observation is that most of the analyses are centered around one particular area of the face or the teeth without considering the dentofacial complex as a whole. Finally, some analyses use angles as their unit of measurement, others use ratios, and others employ direct sizes. It seems to me that an analysis based on geometrical proportion is more likely to be easily and clearly understood and more meaningful than one in which it is necessary to struggle with numbers.

For this reason, I will use, in the assessment of these cases, an analysis that avoids the above-mentioned pitfalls. Instead of taking a fixed plane or a fixed point of reference, I use a construction which is peculiar to each case. For

each case an optimum is defined, and this optimum (not an ideal or an average) is the guide for the differential diagnosis. This analysis is three dimensional and inclusive of all the important structures of the facial skeleton.

A rapid summary of the construction and the norms follows.

DESCRIPTION OF SASSOUNI ANALYSIS[24-25] (FIG. 1)

Orientation of the Frontal and Lateral Films.—On a millimeter sheet (10 by 25 inches), line up the frontal film first (on the right side) so that Lo-Lo (bilatero-orbitale) falls on a heavy horizontal line. Determine the neck of crista galli and place it on a heavy vertical line. Line up the lateral film (on the left side) so that the earrods are on the same horizontal level as the earrods of the frontal film (if they are not horizontal, take their vertical midpoint). Line up the tip of the maxillary central incisor of the lateral film on the same level as the similar point on the frontal film (check the level of menton, basion, odontoidale). Now any point from the lateral film can be projected onto the frontal film, and the reconstruction of the vertical view can be realized.

Lateral View.[24]—

Special definitions: The supraorbital plane is tangent to the anterior clinoid and the most superior point on the orbital roof; practically, this plane follows fairly closely the most superior line demarcating the brain case from the face. Si is the lowermost point on the contour of sella turcica. Sp is the most posterior point on the contour of sella turcica. Point *O* is the center of the focal area where the four horizontal planes of the face (cranial base, palatal, occlusal, mandibular) converge. Te, temporale, is the intersection of the cribriform plate and the MZT (maxillo-zygo-temporal) line.

Construction of the diagram:

Planes. Draw a parallel to the supraorbital plane, tangent to Si. Draw the palatal, occlusal, and mandibular (from symphyses) planes. These four planes converge toward a focal area called center *O*. Generally three of the four planes meet, while the fourth is divergent. This shows the plane which is not integrated in the facial balance. Occasionally only two planes meet at the same point, the two others being parallel or meeting in front of or beyond point *O*. In these cases the junction of the cranial base and the mandibular planes should be taken as the center *O*.

Arcs. From *O* as a center, draw the arcs from nasion, ANS, A, Te, and Sp.

Teeth axes. Draw the axes of $\underline{1}$, $\overline{1}$, $\underline{6}$, and $\overline{6}$.

Measurements. Cranial base to palatal plane angle, palatomandibular plane angle, and ramal to occlusal plane angle.

Axes of teeth. These include $\underline{1}$ to occlusal plane, to palatal plane, to cranial base plane; $\underline{6}$ to occlusal plane, to palatal plane, to cranial base plane; $\overline{1}$ to palatal plane, to occlusal plane, to mandibular plane; $\overline{6}$ to mandibular plane.

Norms:

1. *Planes.* The four planes are converging toward a focal center *O*. One of the planes may be out of convergence.

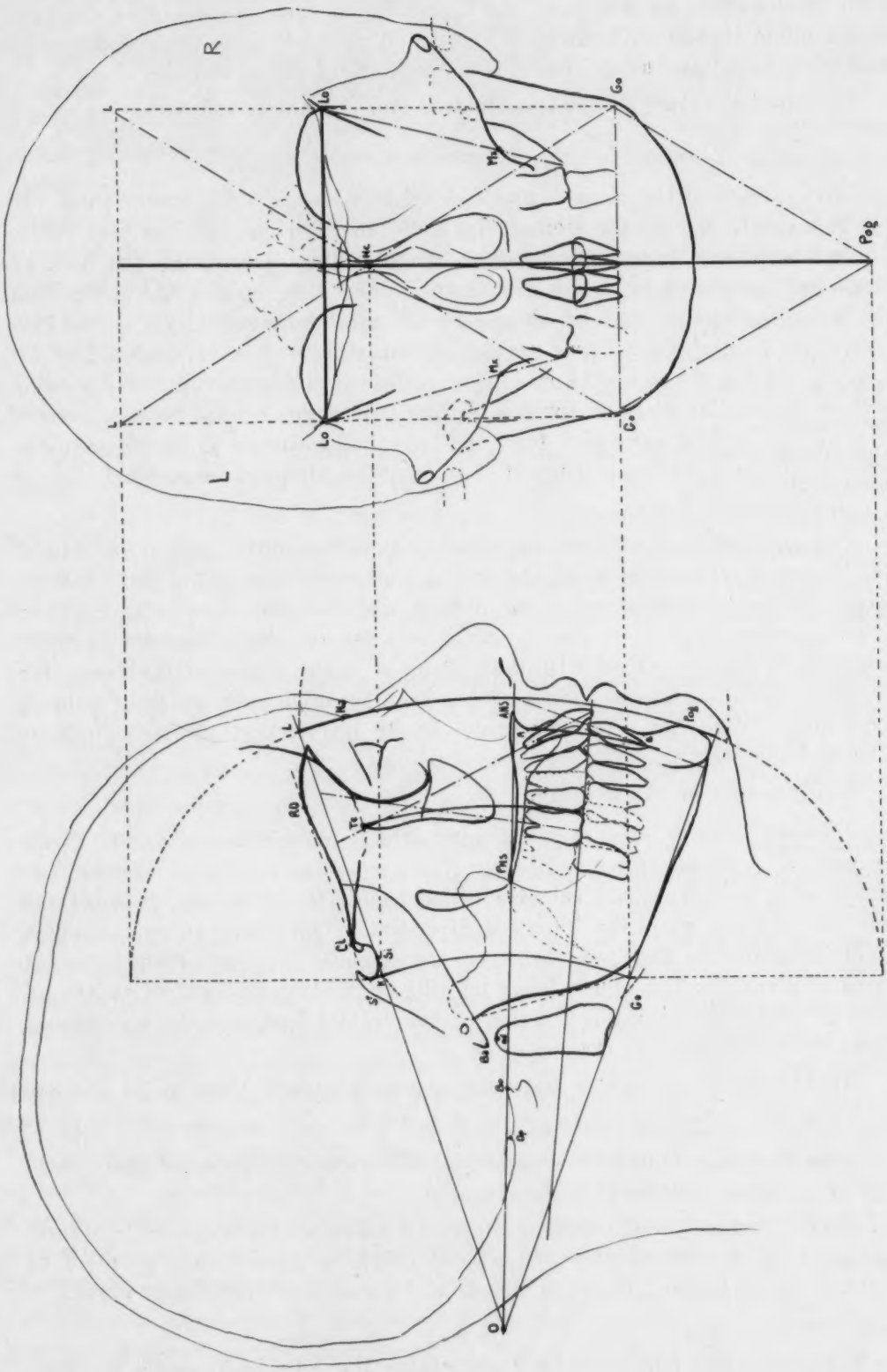


Fig. 1.—Three-dimensional analysis of the lateral and frontal cephalometric x-ray films.

2. *Facial angles.* The cranial base plane to palatal plane angle is equal to the palatomandibular angle.

3. *Arcs.* (a) The arc from Na should pass through ANS, tip of $\underline{1}$, pogonion. If the whole lower face is anterior or posterior to the arc from Na, draw a second arc from ANS down; this should pass through the tip of $\underline{1}$ and pogonion. (b) The arc from point A down should pass through point B. (c) The arc from Te (temporale) should be tangent to the mesial contour of $\underline{6}$. (d) The arc from Sp (dorsum sella) should pass through gonion.

The corpus of the mandible (Go-Pog) is equal in size to the cranial base (from Sp to Na along a radius). In position anteroposteriorly, the corpus of the mandible extends between the anterior and posterior arcs.

4. *Teeth axes.* Tooth $\overline{6}$ with mandibular plane is equal to $\overline{1}$ with mandibular plane + 5 degrees; ramal to occlusal plane angle is equal to $\overline{1}$ to occlusal plane angle; $\underline{1}$ to occlusal plane angle is equal to $\overline{1}$ to palatal plane angle; $\underline{1}$ to occlusal plane angle is equal to $\underline{6}$ to cranial base plane angle; $\underline{6}$ to occlusal plane angle is equal to $\underline{1}$ to cranial base plane angle; $\underline{6}$ to palatal plane is equal to $\underline{1}$ to palatal plane + $\overline{10}$ degrees.

5. *Vertical balance.* The face is symmetrical vertically around the palatal plane; in other words, ANS to cranial base is equal to ANS to mandibular plane, and PNS to cranial base is equal to PNS to mandibular plane.

6. The tip of $\underline{1}$ is situated at the midpoint between ANS and Pog (α). The tip of $\overline{1}$ is situated at the midpoint between A and B (β). The midpoint between α and β is Z.

7. The occlusal surface of $\underline{6}$ is situated on O-Z (vertical position).

Frontal View.[25]—

Special definitions: Lo represents latero-orbitale, the intersection of the oblique orbital line with the lateral contour of the orbit. Nc is the neck of crista galli. Maxillare (Mx) is at the maximum concavity of the contour of the lateral maxilla between the coronoid process and the maxillary first molar.

Construction of the diagram: Trace Lo-Lo and then draw a line perpendicular to it from Nc. Check all bilateral asymmetries on both sides of the perpendicular. Check all vertical asymmetry by comparing to Lo-Lo. Draw Lo-Mx on both sides. Project the length of Sp-Na and Go-Pog on frontal.

Norms: The buccal contour of $\underline{6}\,|\,\overline{6}$ should be tangent to Lo-Mx. Lo-Sp-Lo = Go-Pog-Go = Go-Sp-Go; Lo-Lo = Go-Go.

Part II. Orthodontic Therapies: Their Actions and Limitations (A Critical Review)

Diagnosis not coupled with treatment remains a dead letter, but often treatment exists without diagnosis. Throughout the literature very few control studies exist concerning the actions and limits of these forces. Therefore, the following should be considered as an initial interpretation based mostly on case reports. For the sake of clarity, there are some oversimplifications.

Fig. 1.—Three-dimensional analysis of the lateral and frontal cephalo

One of the major difficulties in the assessment of the effects of treatment is the simultaneous presence of growth. The role of facial growth is still in a controversial state. The prediction of direction and amount of growth within an individual is uncertain. This situation introduces an element of doubt in the claims on the effect of the treatment described in many case reports. Even fewer reports exist on the effects of treatment ten to fifteen years after completion, and they are subject to the same drawback as above.

It is with these limitations in mind that the different aspects of orthodontic therapy will be reviewed. Orthodontic therapy can be preventive, passive, active, and retentive.

PREVENTIVE TREATMENT

When a malocclusion is predicted or detected at an early stage (deciduous dentition or beginning of mixed dentition) often a little intervention prevents its creation or progression.

Space Maintainer.—Early loss of a deciduous molar may originate a mesial drift of a permanent molar, and at a later stage crowding may occur in the anterior portion of the dental arch. The space of the permanent tooth can be preserved by a cap and a rectangular wire. What may require one or two visits now may necessitate a complete two years of treatment later.

Arch Retainer.—During the mixed dentition stage it might be difficult to maintain the space of each tooth separately. A molar-to-molar passive lingual arch resting on the incisor (cingulum) can be used during that whole period.[11]

Correction of Anterior Cross-Bite.—A tongue blade in some cases is enough to jump the bite, if it is done at an early age (3 to 7 years) (pseudo Class III).

Habit Breaking.—Lip-sucking and tongue-sucking call for muscular re-education. Many malocclusions can be prevented if habit-breaking procedures are undertaken early.

PASSIVE TREATMENT (OBSERVATION)

This presupposes a good knowledge of the facial growth and the simultaneous path of eruption of the teeth. Not all malocclusions require treatment. Many reports have been published on *self-correction.*[5, 9] Broadbent[6, 7] has 60 per cent of the cases in his private practice under observation. De Coster,[11, 12] who can see 100 patients a day, is keeping most of them under observation.

One of the general conclusions of Björk[3] is that age (growth) tends to correct the amount of malocclusion, if not its nature. Biprotrusion is normal in young children. It is masked or reduced in adults.

Here the problem of evaluation is the main one. When is intervention necessary? And is it necessary at all? Minute standards for each age, sex, and race are still lacking. Also controversial is the interpretation of these standards when the evaluation of the individual patient is at stake.

ACTIVE TREATMENT

Active treatment presupposes that a decision for intervention, based on a certain diagnosis, is made.

Intervention Without Appliances.—Myotherapy, in its original form, is aimed at the correction of a malocclusion by re-educating the muscular pattern and function.[20(a)] Appropriate exercises tend to release interferences and return the case from the deviation to its normal path of development. Cauhépé and Coutand[10] have the same goal but remark that muscular balance is itself under the control of the nervous system. They recommend re-educating the reflexes of the child. This, in turn, will have its effect on the muscular balance and ultimately help the correction of the malocclusion. Rarely, however, is mechanical therapy entirely avoided.

Limits: Few clinicians have the ability to win the extreme cooperation needed for the success of myotherapy alone.

Functional Treatment.[2, 4]—Activators and monoblocs are the appliances used. They consist of acrylic base made with the teeth and arches in the desired position. They are, for the lingual part of the oral cavity, similar to the positioner. In their original form they are loose in the mouth, so that in order to keep the appliance in position the child is constantly obliged to put his muscles to work and to assume the desired mandibular position. These appliances are worn day and night.

To this original form, auxiliary springs and wires have been added to permit more selective corrections. The more additions made, however, the less functional the activators remain.

Actions: In principle, in the proper hands, the major types of malocclusion can be corrected with activators.

Limits: Great cooperation is demanded from the child. Functional treatment seems to have better results in children in the 5- to 12-year age bracket. Treatment of rotations and space openings are not very successful. Rarely used in the United States, functional treatment is in favor in Europe.

Appliance Therapy.—In this group we find a great variety of appliances. They are, in a sense, more selective in their action. However, hardly any one of them is so universal as to perform every desired change.

For the sake of clarity, they can be divided as to intraoral and extraoral anchorage. Some are fixed; some are removable. Some act on the teeth only; others act on the bony structure. With a bit of oversimplification, it can be said that some have an anteroposterior action, some a vertical action, and others a specific transverse one. It should be understood that very few forces have such a clear-cut, one-directional effect.

Anteroposterior forces:

Class II or Class III elastics are more or less anteroposterior in direction, but when the patient opens his mouth a vertical component is added: The side effect of these vertical tractions is some extrusion of the molars (anchorage) and, consequently, the opening of the bite. If

incisors are to be retracted posteriorly and molars kept in place, the tendency toward mesial movement of the molars can be partly prevented by a lingual arch (6-to-6) along the incisors, by previous tip-back bends, and by a headcap. The anteroposterior force of these Class II or Class III elastics in some cases has an influence on the mandible per se. However, the mandible is slid along the occlusal plane; therefore, the more horizontal the occlusal plane, the more anteroposterior displacement; the more oblique the occlusal plane, the more vertical the repositioning.

The *guide plane* (either in acrylic or wire) imposes to the mandible and the mandibular teeth a predetermined position. It may have a tipping action on the lower incisors. On the mandible, if not used on the proper case at the proper time, it may result in a dual bite.

The *positioner* can be considered as a guide plane at the latest stage of treatment. If cooperation is good, very good results can be obtained. Its action is in part similar to the activator.

The action of the *headcap* is controversial: for some it holds the molars in place while the face grows forward; for others it may drive the molars posteriorly. It is limited by the presence of the second and third molars or by growth failure.

The *positioner combined with the headcap,* proposed by Adams,[1] has retentive action on both arches (kept in normal occlusion) while the face is growing. It has its best application in cases in which some bidental protrusion is present at the end of treatment. It can be called an "active retainer."

The *chin cap* (occipital anchorage) is used to hold the mandible in a posterior position and to interfere with its overgrowth. Age and cooperation are important factors here.

The *chin cap plus maxillary or mandibular molar anchorage* (elastics) has been proposed by Korkhaus.[15, 16] Applied on the maxilla, it brings the maxillary arch forward in midface deficiencies while holding the mandible. On the mandible with retruded dental arch and alveolar bone, it brings forward the mandibular arch but not necessarily the mandible. Best results are obtained in cases without crowding and with uprighted teeth.

Vertical forces:

Vertical elastics are used on incisors to close an open-bite. Good results are obtained when the open-bite is due to habits (thumb-sucking). Vertical elastics seem to be insufficient when we have to deal with a structural open-bite.

A *bite plate* at the incisor or molar level is used to open the bite or to depress the lower incisors. Generally, depression of the incisors is more difficult to obtain than eruption of the buccal teeth. The dental result is the same either way. Facially, however, egression of the molars results in an increase of lower facial height (ANS-Me).

The *headcap* (parietal anchorage) provides vertical extraoral traction to depress the buccal segment of the maxillary arch. It probably exerts a holding action during growth. It is effective in open-bite cases.

The *chin cap with frontal anchorage* is also used for treatment of open-bites. Cooperation is vital.

Transverse forces:

Vertical cross elastics have both a vertical and a transverse effect for correction of cross-bite. They work well when individual teeth are involved.

Expansion arches (labial or lingual) are used mainly for dental lateral movements. Although their use has been in favor, relapses have discouraged many. The amount of expansion and the choice of the proper case seem to be the important factors.

The *palatal split* is a palatal plate separated into two halves with an expansion screw between them. A rapid expansion force (two or three days) at regular three-hour intervals brings the separation of the medial palatal suture. Then the plate is used as a retainer during the three-month period of the new bone formation. The palatal spit creates a permanent widening of the maxilla proper, the maxillary arch, and the nasal cavity. Best results are obtained in the 6- to 13-year age bracket. Selection of the proper case is important.

Macary's[18] *lateral traction* appliance is basically an activator with two lateral elastics that the child holds in both hands and exercises himself. Expansion is obtained, breathing is improved, and new reflexes are created. Cooperation of the patient is necessary.

Surgical Treatment.—

Tooth extraction: Four premolars can be extracted serially[30] (either the first premolars or the upper second and the lower first premolars, or vice versa) in crowded cases with a tendency to biprotrusion. The main problem is the closure of the spaces and the prevention of mesial drift of the anchorage. Tooth extraction can be also atypic,[21, 32] involving any tooth, such as the lower central incisor and the upper second molars. This may raise problems of interdigitation. The problem of extraction is at present controversial, not so much as regards nature (everybody agrees that it is necessary in some cases) but as regards amount (in which cases teeth should be extracted). Controversial also is the influence of extractions on facial growth. In extraction cases it is often a good policy to make a diagnostic setup on dental models.

Bone:

Mandibular resection is used mainly for correction of a Class III condition that is beyond the possibilities of appliance therapy. Mandibular resection can

be performed at the condyle, at the ramus, at the angle, or on the corpus. It requires a close cooperation between the orthodontist and the oral surgeon. Good study models with the cut are mandatory. Results are good when growth is already achieved (adult). Some of the tooth movement can be achieved before the operation, thus reducing postoperative intervention.

Premaxillary resection is performed in cases in which the premaxilla and the incisors are tipped excessively forward. Teeth have to be sacrificed. This operation opens the nasal cavity or involves the alveolar bone only.

Intervention on muscle. Reinsertion of the masseter (still in a research state). This is proposed for early treatment of true mandibular prognathism.

RETENTION

The problem of retention has been given relatively little attention. It might be considered, however, as one of the most important steps in orthodontic therapy. From its proper application comes the success or failure and the permanence of the treatment. Rules are difficult to set up for retention because of its close adaptation with the type of treatment used. After a functional treatment (activator) no specific retention is supposed to be needed. Tooth rotations, on the other hand, require a long retention. Correction of a crowded incisor condition probably needs some sort of retention up to the eruption of the third molars. This is not necessarily due to a mesial drift tendency of the third molars; it may be due also to a concomitant growth of the mandible.

CONCLUSIONS

This rapid review, which is intended to be only a brief reminder of the orthodontic armamentarium, brings to light some interesting facts.

There is no universal appliance that can be used without discrimination in all cases. Differential treatment is necessary.

For individual cases there is one best appliance in terms of optimum results (functional, esthetic, and permanence) with a minimum amount of intervention (economy of means, economy of time, and minimum biologic interference).

A key statement in the evaluation of each appliance is that it gives the best result, "in the proper case, at the proper time." In other words, this means that diagnosis would suggest the type of treatment.

Diagnosis comes first; it should lead to the selection of the proper intervention to be performed in each individual case.

PART III. SYNTHESIS BETWEEN DIAGNOSIS AND TREATMENT: FIVE CASE PRESENTATIONS

With cephalometric analysis in one hand and with the orthodontic armamentarium in the other, we now can, with an alternate weighing, evaluate and

decide. Part III should be considered as the synthesis of the two previous parts of this article. The problem is no longer of a theoretical nature; it has now become one of practical clinical application.

Five cases are presented here. They have been selected at random from the files of the Orthodontic Department at the University of Pennsylvania. They are not extreme cases but the kind we find in everyday practice. These five cases will be supplemented by a number of others to illustrate some specific point.

As far as the proposed treatment is concerned, it should be clear that there is probably more than one way of achieving the same result. The guiding principle followed here is economy—economy in terms of intervention, in terms of time, in terms of mechanotherapy, and in terms of patient cooperation. Function is one of the cardinal points in our achievement. However, what constitutes "normal function" is one of the most nebulous aspects of the problem. Esthetics is important, but not the subjective esthetic appraisal of the operator. The best esthetic balance of the individual child should be searched for within his own racial and familial pattern. A second point to remember in connection with esthetics is that childhood is only a few years of time followed by adulthood, the longest stage in a life span. Treatment should be planned with a view to the future, when the child achieves his growth. Trying to give a child an adult face (bidental retrusion, mandibular protrusion) may prove disastrous when he reaches adulthood. Permanence of the results depends upon the treatment decision and the care given in retention. It presupposes a good knowledge of normal faciodental balance. These are the guiding principles in the selection of a particular treatment.

CASE REPORTS

CASE 1.—The cephalo-dento-facial analysis of Patient L. M. follows on pages 444 to 447.

CASE 2.—Patient C. V. (Fig. 2), a 9½-year-old boy, had a skeletal age of 10 years 9 months. His dental age was III B Hellman (mixed dentition).

Occlusion.—Class II, Division 1; no centric position, no contact; excessive overjet; some spacing on maxilla; total mandibular lingual cross-bite; crowding in mandibular incisors; $\overline{2}|$ lingual in position.

Diagnosis.—

Anteroposteriorly: This is a I B type of face: the cranial base plane is out of convergence. The palatal plane is slightly above the foramen magnum. The profile is retroarcheal (ANS, $\underline{1}$, Pog posterior to arc from Na). Compared to the maxilla, the mandible is 8 mm. retrusive (Pog posterior to arc from ANS). The mandibular alveolar bone and dental arch are 8 mm. retrusive (B posterior to arc from A); $\underline{1}$ is 4 mm. protrusive (compared to arc ANS); $\underline{\overline{6}}$ is 2 mm. mesial. The corpus is 12 mm. short anteriorly.

Vertical assessment: Extremely deep overbite. The anterior lower face is 15 mm. smaller than the upper face.

Breadth: Upper to lower face (Lo Lo to Go Go) well proportioned. The maxillary molars are 3 to 4 mm. too lateral (compared to line Lo-Mx), while the mandibular arch is in complete cross-bite lingually.

Symmetry (according to perpendicular to Lo Lo through Nc): Good skeletal symmetry between left and right sides, both vertically and transversally. Maxillary dental midline is good. Mandibular midline is off to the left.

CEPHALO-DENTO-FACIAL ANALYSIS

Viken Sassouni
Graduate School of Medicine,
University of Pennsylvania

Date 4-4-56

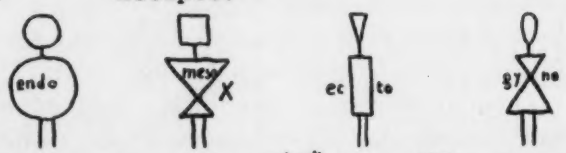
I. General Information

Name: L.M. Case #1 Sex: male
Address: Phone:

Age: Chronological: 11:9
Skeletal: 12:3
Dental: III C

Occlusion (Angle-Dewey): II (1)
Overbite: Excessive Crossbite: ✓
Spacing: Max. incisors Crowding: ✓
Missing teeth: ✓ Ectopic: ✓

Constitution:
Height: 59.39'
Weight: 95 Lbs



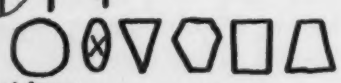
Family-line:
Mother: age 38 ; occl. I ; Ht. 5'5" ; Wt. 180 ; Type Endo
Father: age 37 ; occl. I ; Ht. 6' ; Wt. 195 ; Type Meso
Resemblance according to parents: Father
X-ray findings:

Past History: nothing indicative

Present Status: nothing indicative

Facial (Subjective Appraisal):
Profile (ant. post): (I) II, III, convex concave
Vertical:

Transverse:



Functional Examination:
Free balance of head uprighted
Rest position of mandible 5mm
Swallowing tongue between incisors

II. Roentgenographic Cephalometry

A. Lateral Film

(1.) Antero-posterior assessment

	Case	Norms
1) Planes:		
type	IV A	3 or 4 pls.meet at O
position of palate	slightly below	thru Ba-Od-Bo-Op
position of mandibular pl.	below occip.	acc. to Foramen M.
2) Arc:		Na arc passes thru
Profile type	Retro arcneal	ANS, 1, Pog
3) Mandible:		
size of corpus (=Sp-Na)	good	Go-Pog = Sp-Na
position of corpus (at Go+Pog)	2mm retruded	Pog on ant. arc. Go on post. arc.
position of pt.B comp.to pt.A	4mm retruded	B on arc A
4) Maxilla:		
position of maxilla	lower face retruded	ANS on ant. arc
5) Maxillary dental arch:		
position of 1	- 4mm protrusive	on ant. arc
position of $\underline{6}$	- 2mm mesial	tg to median arc Te
6) Mandibular dental arch:		
B to Pog	retrusive mand. arch	B and Id on Arc A
Id to Pog		
7) Teeth axes:		
1 to occl. = $\overline{1}$ to palate	51/61	when B on basal arc
Dental cone	Low	
8) Angles:		
gonial	120°	
clivus-[illegible] mand.	85/95	equal
ramal-orbital		

Objectives of treatment antero-posteriorly

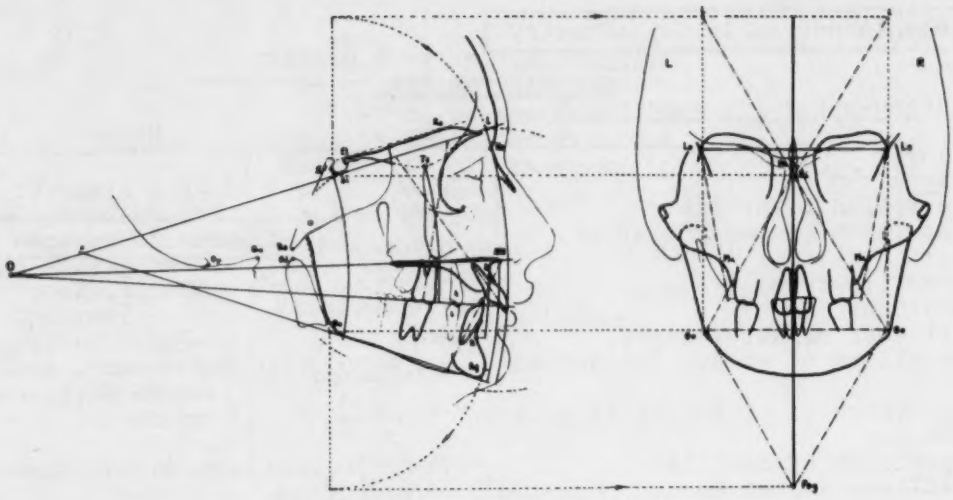
Bring max. arch posteriorly: more at incisors (4mm) than molars (2mm)
Bring mand. arch forward (4mm)
Bring mandible forward (2mm)

(2.) Vertical assessment

1) Ant. lower face (ANS-Me) to ant. upper face (ANS-L)	ant. lower face 5mm small	equal
2) Post. lower face (PNS-Go) to post. upper face (PNS-K)	Post. lower face 6mm small	equal
3) Vert. position of 1 (ANS-Pog :2)	rotate around ap ex	midpoint
4) Vert. position of $\overline{1}$ (A-B :2)	depress 2mm	
5) Vert. position of $\underline{6}$	2mm intruded	on O-Z
6) Ant-post. and Vert. ratio = K-Go to K-L	equal	equal

Objectives of treatment vertically

obtain a larger lower face height
Reduce the overbite.



B. Frontal Film

1. Breadth assessment

	Case	Norm
1) Skeletal: upper face (Lo-Lo) to lower face (Go-Go)	equal	equal
2) Dental: position of 6|6	narrow 7mm	tg. to MxLo

2. Symmetry

1) Skeletal } according to perpendic-	very good	
2) Dental } ular to Lo-Lo from Nc		

Objective of treatment transversally
expansion of max. dental arch

C. Vertical View (from lat. and P-A films)

1) Cranial base: Sp-Lo to Lo-Lo	good	equilateral
2) Mandible: corpus (Go-Pog) to Bigonial	good	equilateral
3) Dental: 6|6 to bigonial	good	

Observations on films

D. Summary of Cephalometric Diagnosis

This is basically a dental and not a skeletal or growth problem. This is a case where I feel, cephalometric analysis is necessary mostly for growth progress evaluation

III. Model Analysis

Regular dental arches.
Spacing between maxillary incisors
Narrow max. dental arch

IV. Treatment

A. Objectives:
Anterior-posterior bring max. arch post. and mand. arch forward
Vertical increase post. dental height (alveolar)
Transverse expansion of maxillary arch.

B. Limitation:
Genetic good
Morphologic good
General health good
Cooperation good

C. Prognosis: good

D. Timing: no Reason to delay treatment

V. Appliance Therapy

This is a typical case for the use of cl. II elastics: This will realise simultaneously the antero posterior movement desired and also the vertical (post. alveolar) increase desired.

This can be accomplished by the classic Johnson's twin-arch. However, for the expansion, Labio-lingual technic may be more effective.

Both can be used.

The regularity of the arches do not require the banding of all teeth.

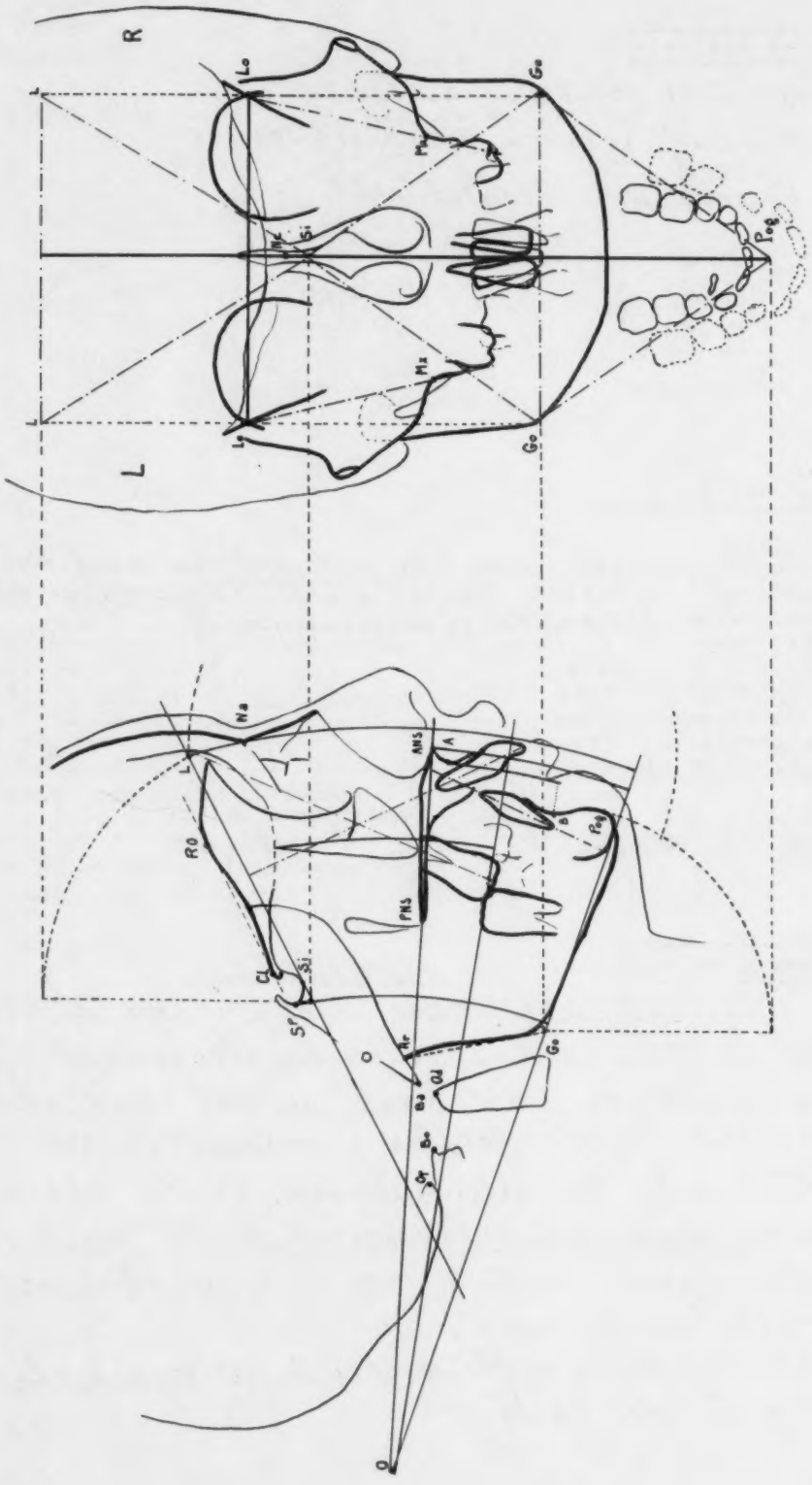


Fig. 2.—Case 2. Patient C. V.

Vertical view of mandible: Shows again that the corpus is 15 mm. shorter when compared to the bigonial breadth.

Treatment.—

Objectives:

Anteroposterior. Bring mandible forward.

Vertical. Correct overbite and anterior lower face height.

Transverse. Correct cross-bite.

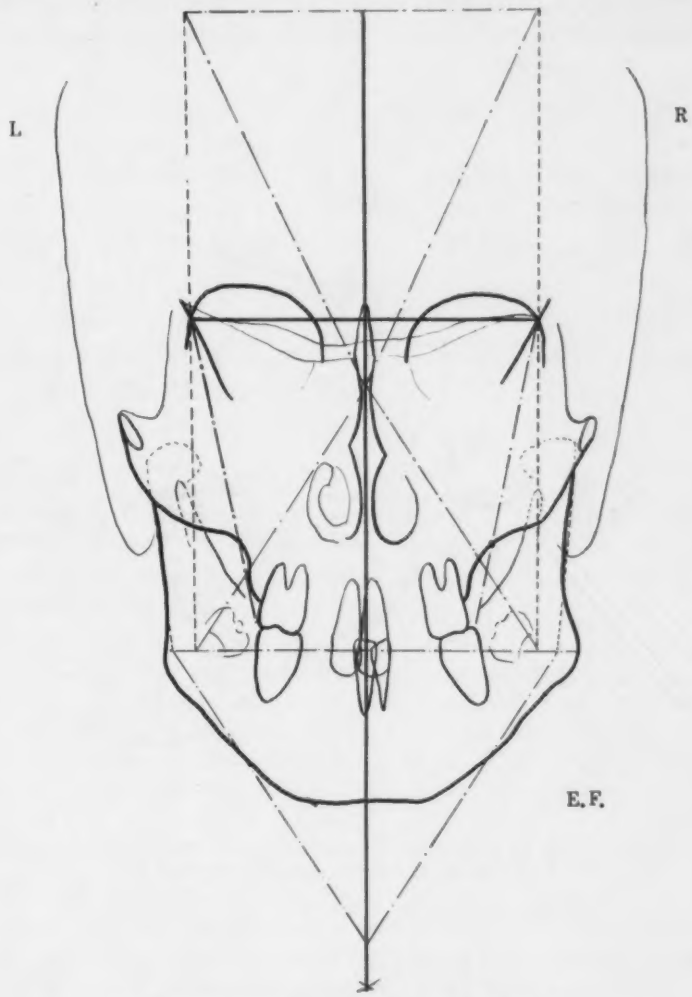


Fig. 3.—Patient E. F. (supplement of Case 2).

Prognosis: Poor if growth does not help. Growth at condyle and repositioning are the important factors. According to Björk,[5] "bite-raising poor prognosis in slender children = less growth activity."

Timing: Prognosis would be much better if child had been seen at a younger age. However, the prepubertal spurt may be helpful yet. Do not lose any time. (This child is advanced 1 year 3 months in skeletal age.)

Appliance Therapy.—

1. Refer to a pediatrician and endocrinologist for general checkup.

2. Orthodontic:

A. This is the type of case in which functional treatment gives good results. One limitation is that the patient is slightly old and the cooperation that can be expected from him is uncertain.

B. Guide plane on maxilla (to hold the deciduous spaces) and bite plane. Expansion arch on mandible. Later, when occlusal contact is established, Class II elastics can be used with a good multiband anchorage (in permanent dentition). A 3 to 4 mm. constriction is indicated on maxillary teeth.

C. Because of the growth factor, do not expect treatment to be achieved quickly.

D. Retention expected to be long (re-education of whole musculature).

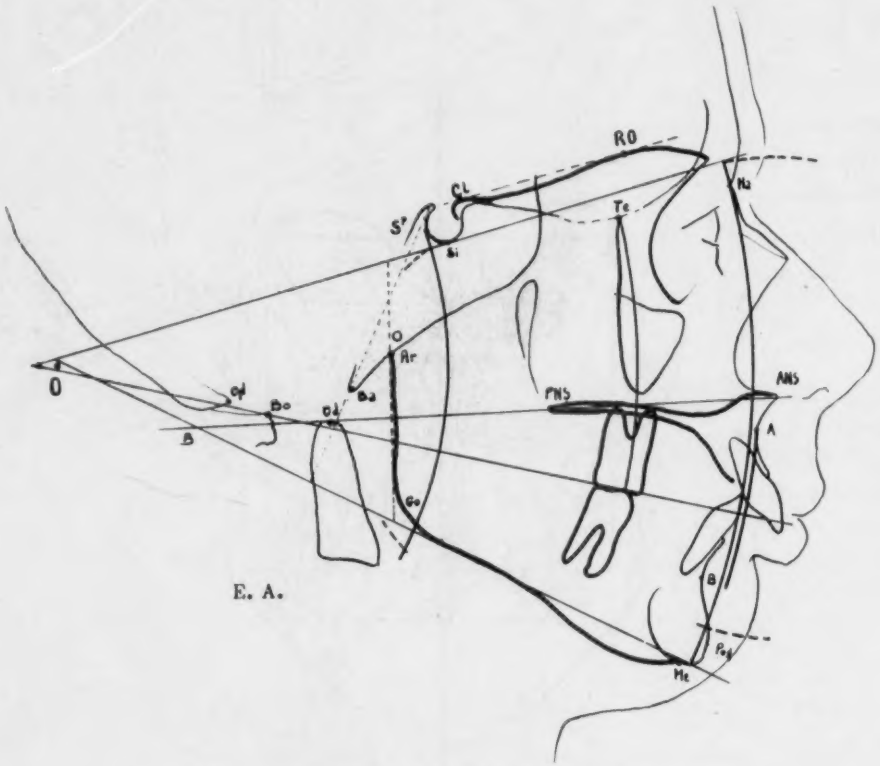


Fig. 4.—Patient E. A. (supplement of Case 2).

Supplementary Cases.—The most striking feature in the case of Patient C. V. is the mandibular lingual cross-bite. Patient E. F. (Fig. 3) presents a similar but milder case, in which there is a maxillary lingual cross-bite in the right molar area. Notice that on the right side $\underline{|6}$ is 3 mm. lingual to line Lo-Mx, while on the left side $\underline{6|}$ is well positioned.

Treatment: Unilateral expansion. Notice here also that bigonial diameter is larger than Lo-Lo.

Anteroposteriorly, Patient C. V. had a small and retrusive mandible. Patient E. A. (Fig. 4) has a large corpus with a well-situated Pog; here the maxilla (ANS, A, $\overline{I}$) is entirely protrusive. This is a convex type of profile. Notice the shape of the palate, which is concave as if the whole premaxilla were bent anteriorly and upward. The treatment here should be done by headcap acting on the whole maxillary dental arch. A less conservative treatment would be a premaxillary resection with the extraction of $\underline{4|4}$, bringing the whole premaxilla (from canine to canine) backward and downward.

CASE 3.—R. M. (Fig. 5), a boy aged 14 years 3 months, had a skeletal age of 13 years 9 months and a dental age of IV A.

Occlusion.—Class II, Division 1, with mesial drift of right maxillary buccal segment and distal drift of mandibular teeth (mostly incisor and left buccal segment); excessive overbite and overjet; spacing between maxillary incisors; $\lceil\overline{6}$ extracted; crowding in upper right; $\underline{3}\,|$ blocked labially.

Diagnosis.—

Anteroposterior: Type III B. Retroarcheal profile. Compared to the maxilla the mandible (Pog) is in nearly good position. The mandibular alveolar bone and dental arch are 6 mm. retrusive; $\underline{1}$ is 5 mm. protrusive; $\underline{6}$ is mesial in position. The corpus is small in size.

Vertical assessment: Large anterior lower face height (7 mm.); $\underline{6}$ and $\overline{1}$ are extruded (2 mm.).

Breadth: Large bigonial diameter (6 mm.). Narrow bimolar diameter (3 mm.).

Symmetry: The head is rotated to the left. Mandibular midline off to the left.

Vertical view of mandible: Confirms shortness of corpus.

Treatment.—

Objectives:

Anteroposterior.—Bring mandible and mandibular arch forward and drive maxillary arch posterior.

Vertical.—Depress $\underline{6}$ and $\overline{1}$.

Transverse.—Expansion on maxillary arch.

Prognosis: Good if general health is restored. Good anterior posteriorly because cranial-palatal angle is equal to palatomandibular angle.

Timing: Now. At adolescence a spurt of growth, particularly at the mandible, may be expected to be favorable.

Appliance Therapy.—The lower face being larger than the upper, use of Class II elastics should be avoided. It might extrude the molars. Bite plane and guide plane would have the same effect; they would have been good to depress the lower incisors. More important than just bringing the mandible forward (by unlocking the cusp interferences) is the bringing of the mandibular arch forward on the mandible (with this chin button, there is little danger of biprotrusion appearance). Use either a lingual or labial arch; depress incisors.

Use headcap (occipital) on maxilla with slight expansion and vertical force on buccal teeth to depress them.

During the day Class II elastics may be used, not anchored on molars but on labial arch.

After the gross correction is done, use Macary's functional therapy to achieve better breathing and to improve the midfacial development. It serves also as a retention.

I do not think that extraction should be done in this case, especially in the mandible. In the maxilla, $\underline{8\,|\,8}$ are extremely small and $\underline{6\,|\,6}$ are in very poor shape. I will not be surprised if their extraction is done before the patient reaches 25 years of age. As a last resort, only $\underline{4}\,|$ could be extracted, but that might create problems of midline and interdigitation.

Supplementary Cases.—One of the most important features of the case of patient R. M. is the retrusion of the mandibular dental arch, probably due to the extraction of $\lceil\overline{6}$. A similar case is that of patient T. R. (Fig. 6). The whole lower face of patient T. R. is retruded (or Na is protruding). The mandible (Pog) is well positioned as compared to the maxilla (ANS). The mandibular dental arch (point B), compared to the maxillary

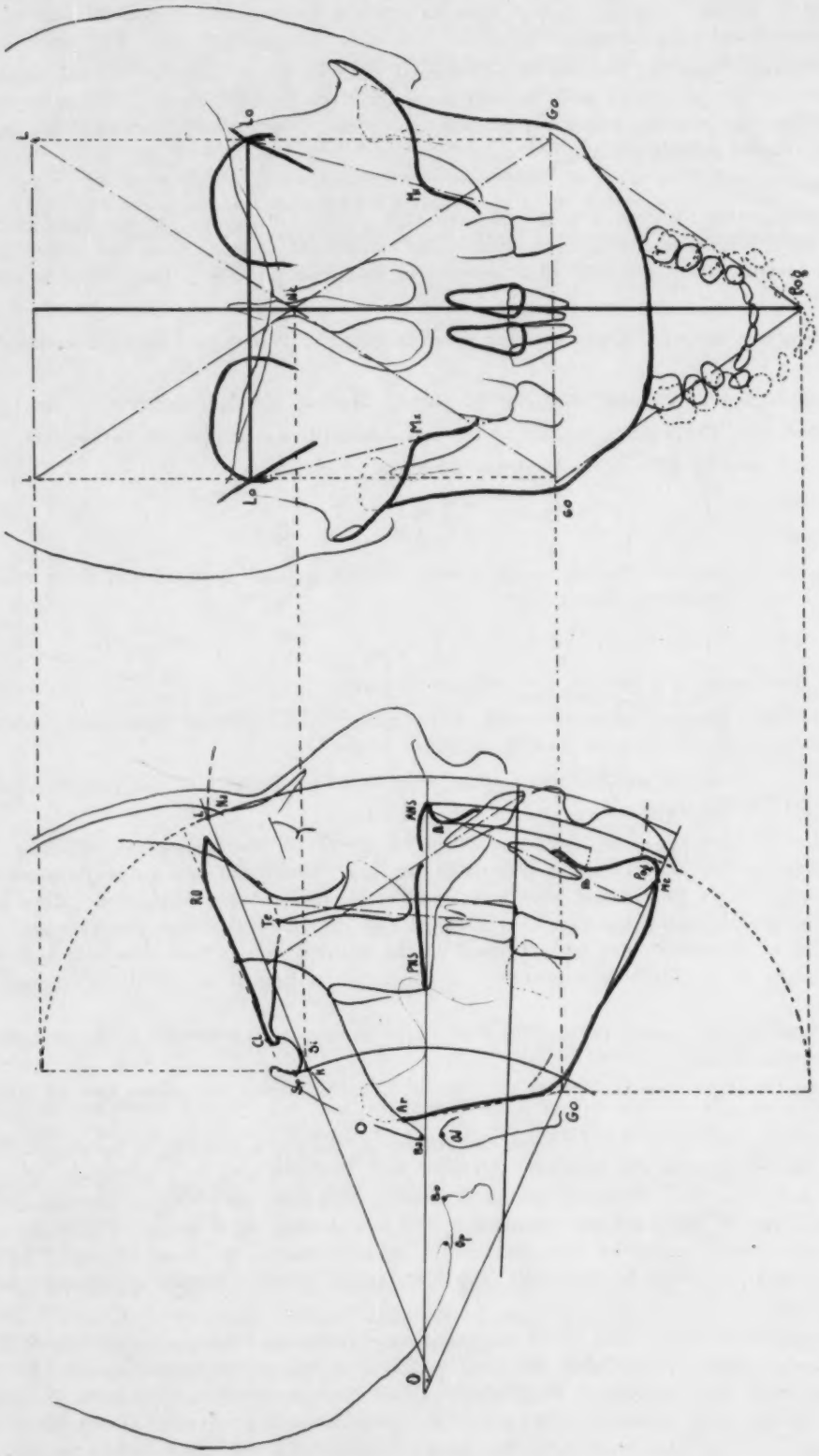
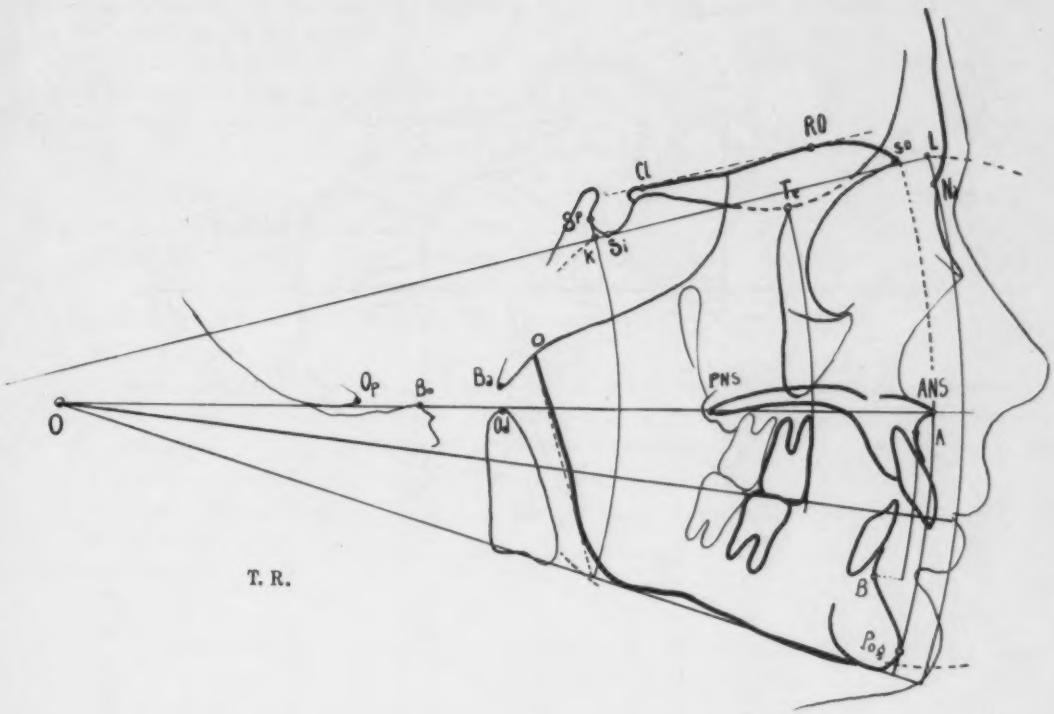


Fig. 5.—Case 3. Patient R. M.

Fig. 6.



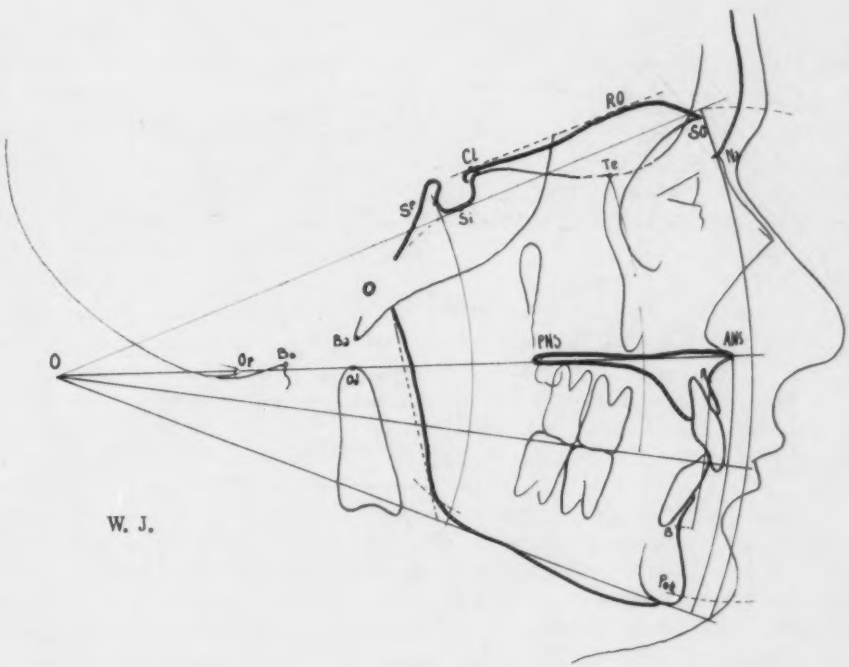


Fig. 7.

Fig. 6.—Patient T. R. (supplement of Case 3).
Fig. 7.—Patient W. J. (supplement of Case 3).

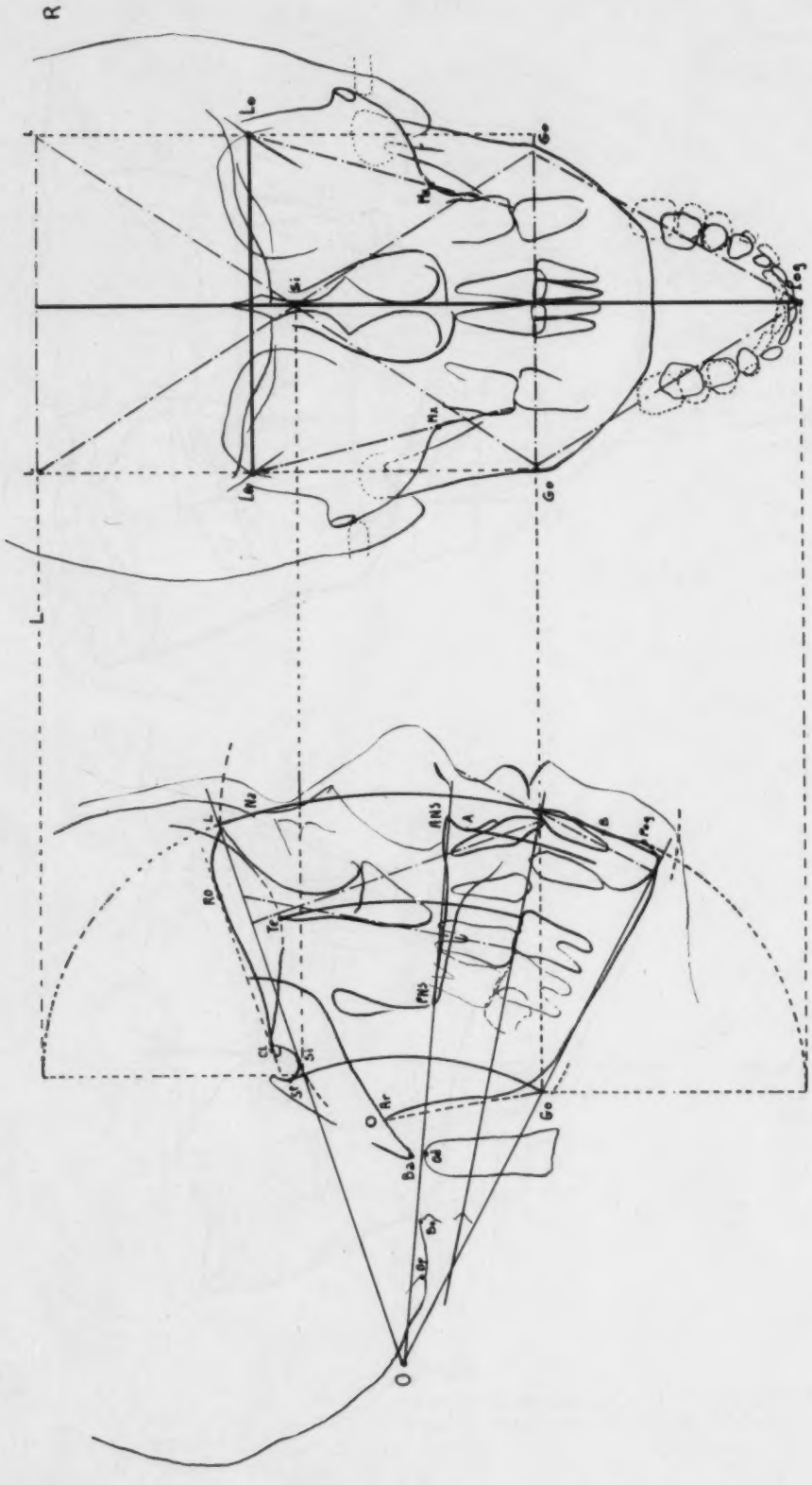


Fig. 8.—Case 4. Patient E. Z.

arch (point A), is retrusive. To correct this malocclusion, a chin cap with a mandibular molar anchorage should be the best appliance to use in bringing the mandibular arch, but not the mandible (Pog), forward.

The case of Patient W. J. (Fig. 7) is similar also. This patient is a 17-year-old girl and, therefore, her growth is nearly achieved. The shortness of the corpus is definitive. Repositioning of the mandible anteriorly is uncertain. In order to correct the crowded condition of both arches, premolar extraction probably should be decided upon.

CASE 4.—Patient E. Z. (Fig. 8), a boy aged 14 years 1 month, had a skeletal age of 13 years 3 months and a dental age of IV A.

Occlusion.—Class III; slight overbite; $\underline{8|8}$ are probably missing; anterior $\underline{1|1,2}$ lingual cross-bite; slight crowding; unduely retained $|\overline{V}$. At rest the mandible swings backward; this leads me to think that this is a pseudo Class III case.

Diagnosis.—

Anteroposterior: Type III B. Profile is slightly concave due to maxillary retrusion. Point B is 9 mm. anterior to point A. The mandible is good in size and position. Lack of chin due in part to a mesial position of the mandibular dental arch.

Vertical assessment: Slightly small lower facial height.

Breadth: Narrow bigonial (6 mm.), wide maxillary diameter (3 mm.).

Symmetry: Good.

Treatment.—

Objectives:

Anteroposterior. Round off the maxillary incisors and bring the mandibular arch posteriorly.

Vertical. Increase vertical lower face.

Transverse. Constriction of maxillary bimolar diameter.

Prognosis: Functional prognosis is good; esthetic prognosis is good if headcap is used on mandibular arch.

Appliance Therapy.—Since the maxillary $\underline{8|8}$ are absent, and since $\overline{7|7}$ are of the same size as $\overline{6|6}$, I would consider extraction of $\overline{6|6}$. Band all mandibular teeth and use a cervical strip to move them posteriorly. To jump the bite, use maxillary buccal surelevation. Labial arch on maxilla, (1) for constriction and (2) to realign the maxillary incisors. This case may become a biprotrusion if care is not taken. It presents a similar and reverse picture of Case 5.

Supplementary Cases.—Patient E. Z. has a mild dental Class III occlusion. Its interesting feature is the presence of a slight underdevelopment of the premaxilla and a forward drift of the mandibular dental arch.

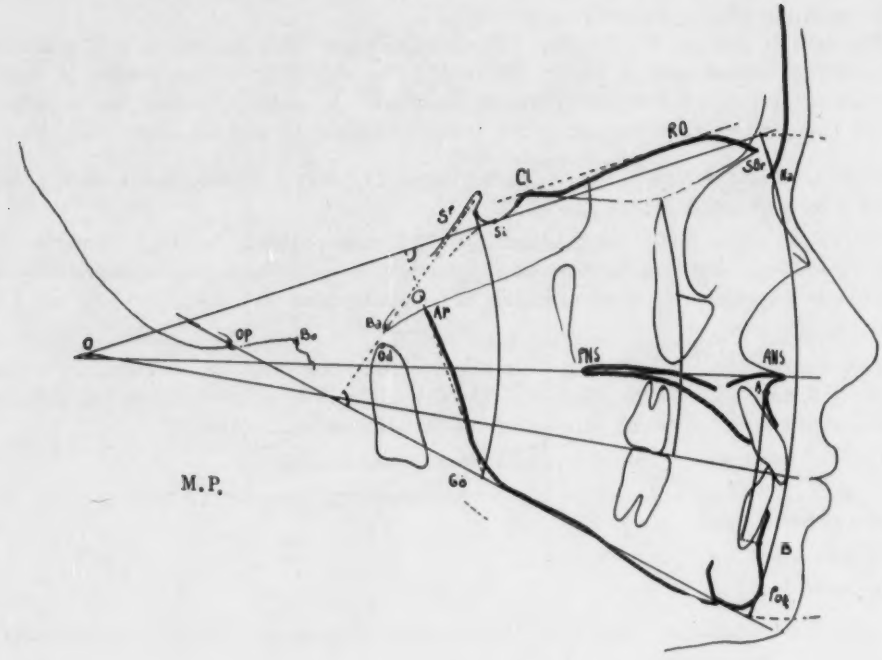
Among fifty children with normal occlusion and the same age range as E. Z., the closest I could find is M. P. (Fig. 9). Similar features are: corpus well positioned and well proportioned; ANS retrusive; and point B in front of point A. This exemplifies the possible result with the treatment of Patient E. Z.

Patient A. K. (Fig. 10) presents similar features: retrusion of the maxilla; corpus well proportioned, but forward in position (Pog in front of anterior arc, Go anterior to posterior arc). This case can still be treated orthodontically.

Patient D. Ro. (Fig. 11) is beyond appliance therapy; surgery should be resorted to. Here again, maxillary retrusion is coupled with mandibular protrusion. The difference between this and the preceding case (Patient A. K.) is one of degree rather than of nature.

The case of Patient K. K. (Fig. 12) is similar to that of Patient D. Ro., with the difference that here the picture is complicated by an open-bite and crowding. The open-bite is due to a lack of vertical development of the posterior facial height coupled with a lack of vertical development of the premaxillary alveolar process. Falcrum is $\underline{6}$. Orthodontic treatment should be tried here to depress $\underline{6}$ and extrude incisor block. If that fails, then surgery will be indicated.

Fig. 9.



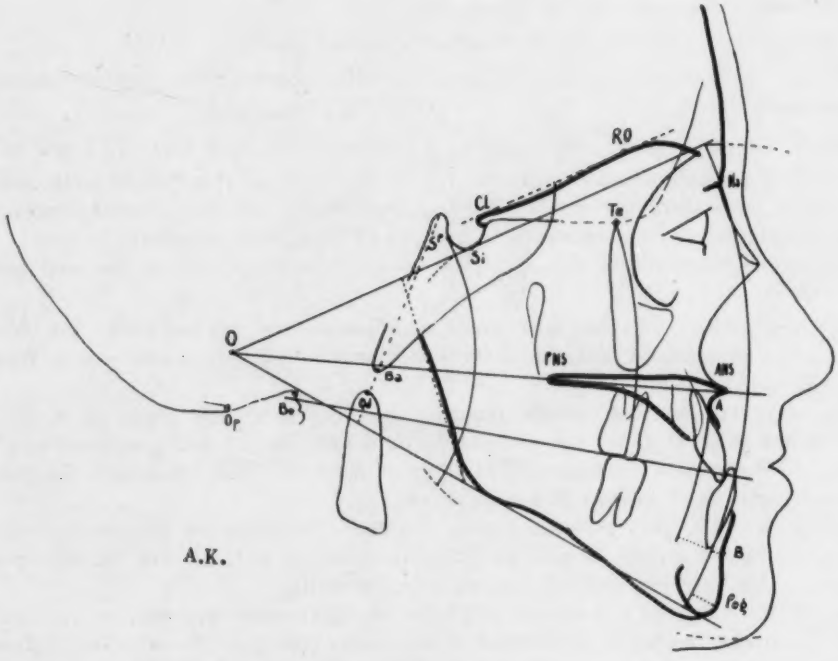
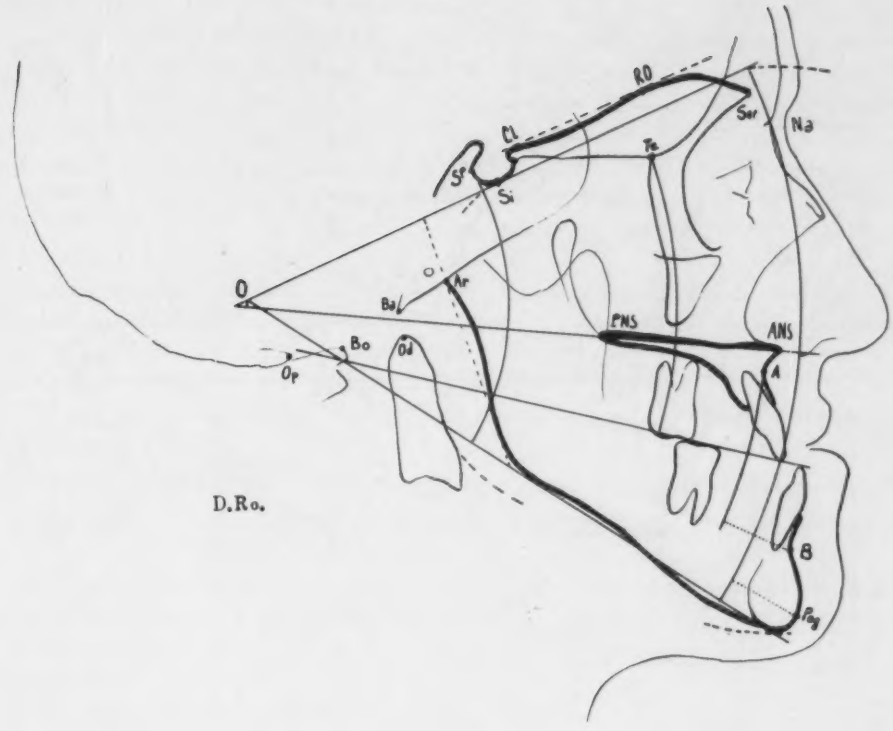


Fig. 10.

Fig. 9.—Patient M. P. (supplement of Case 4).
Fig. 10.—Patient A. K. (supplement of Case 4).

Fig. 11.



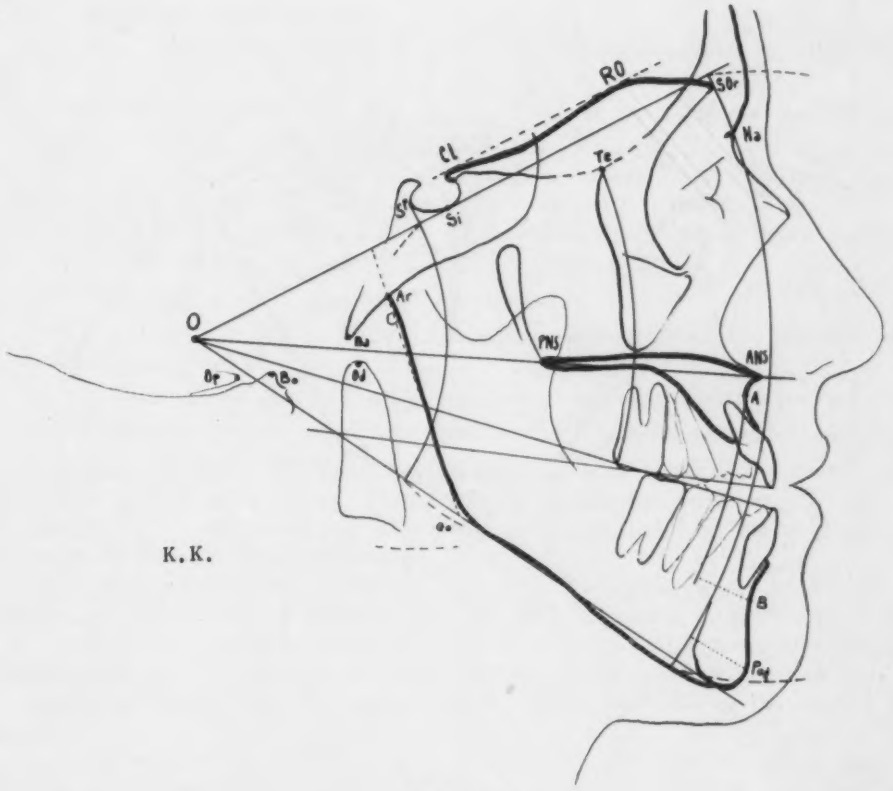


Fig. 12.

Fig. 11.—Patient D. Ro. (supplement of Case 4).
Fig. 12.—Patient K. K. (supplement of Case 4).

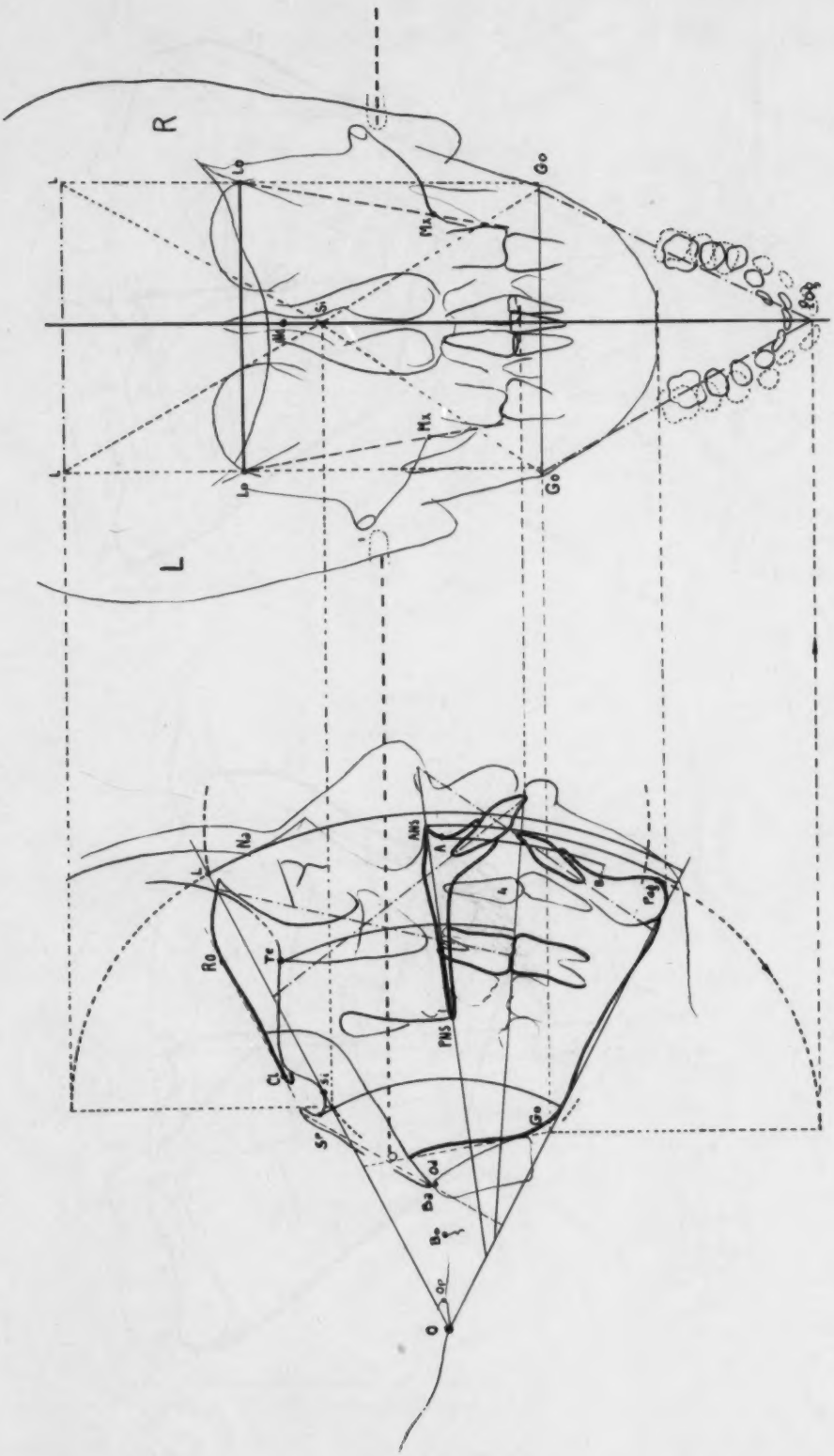


Fig. 13.—Case 5. Patient R. B.

CASE 5.—Patient R. B. (Fig. 13), a boy aged 12 years 7 months, had a skeletal age of 12 years 3 months. His dental age was III B, closer to III C.

Occlusion.—Class I, Divisions 1 and 2; slight Class II at canines; more overjet than overbite; some spacing in upper teeth; crowding in lower teeth; ectopic $\lfloor \overline{1,2}$.

Functional Examination.—Rest position, 2 mm.; short lower lip (vertically). In order to close his lips, he brings his mentalis high at the level of supramentale. For his bony structure, he has a short lip.

Diagnosis.—

Anteroposterior: Types II and III B. Palatal plane below foramen magnum. Slightly retroarcheal profile. Corpus large in size (2 mm.). Compared to maxilla, corpus is well situated (Pogonion). Point B is 3 mm. retrusive. Extreme protrusion of $\underline{1}$ (10 mm.); $\overline{1}$ protrusive at a lesser degree.

Vertical assessment: Large anterior lower facial height (10 mm.); short ramus. Extruded $\overline{1}$.

Breadth: Upper and lower face well proportioned. Good maxillary bimolar diameter.

Symmetry: Facial symmetry, good; midline of upper and lower incisors shifted to the left.

Vertical: Long and narrow mandible. Compare with Case 2 in which there is an opposite picture, that is, a short and wide mandible.

Treatment.—

Objectives:

Anteroposterior. Reduce biprotrusion.

Vertical. Increase ramal height; reduce anterior lower facial height.

Transverse. Nothing.

Prognosis: Functional prognosis is good; esthetic prognosis is good within the racial frame.

Timing: Slightly late to expect or produce a special growth at the condyle.

Appliance Therapy.—If the racial factor is not considered, this is a typical case for treatment by Tweed's method: extraction of four premolars, with more work done with headcap than Class II elastics to avoid opening lower facial height.

This child being of Negro origin, however, the esthetic objectives are open to discussion. If the pattern is to be kept, the following may be considered:

1. Extraction of $\lfloor \overline{1}$ plus lower lingual arch.
2. On the maxilla, closure of spaces and holding back the maxillary denture with occipital headcap.
3. Vertical chin cap with molar surelevation to favor condylar growth.
4. After treatment use Adams'[1] combination of positioner and headcap.

Supplementary Cases.—The main feature, besides the racial factor, is the bidental protrusion and its associated skeletal features—large palatomandibular angle (larger than orbito-palatal angle); large anterior lower face, small posterior lower facial heights; short B to Pog; A to ANS; Bi-incisal protrusion.

Let us consider the case of Patient T. S. (Fig. 14), a white (Irish) boy of nearly the same age. All features of Patients T. S. and R. B. superimposed perfectly. Therefore, the question arises: "What is the racial factor?" It is probably a matter of frequency; biprotrusion and associated features are more frequent in Negroes than in Caucasians.

All the features of the same skeletal pattern are present also in the case of Patient M. J. (Fig. 15).

In those cases, for the decision as to treatment, I feel that we should turn to the direct family background. In Case 5 Patient R. B. resembles his father. On what grounds should we change his pattern (if we could)? In this case I will lean toward a conservative approach and not extract four premolars.

Fig. 14.

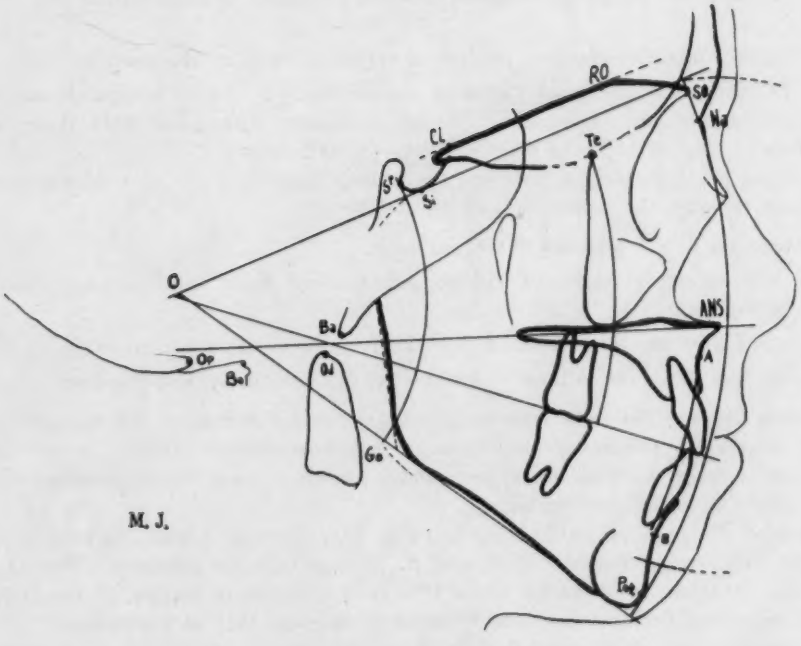
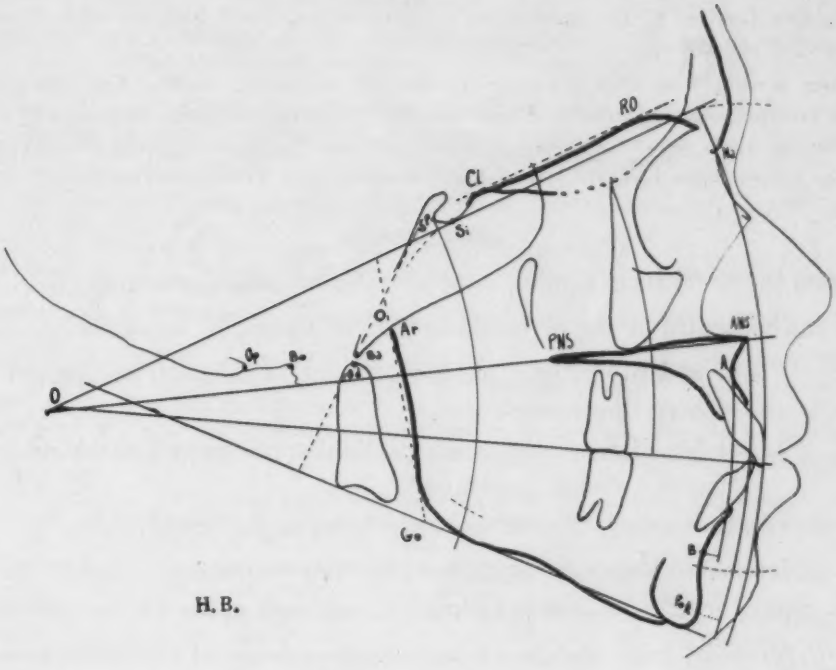


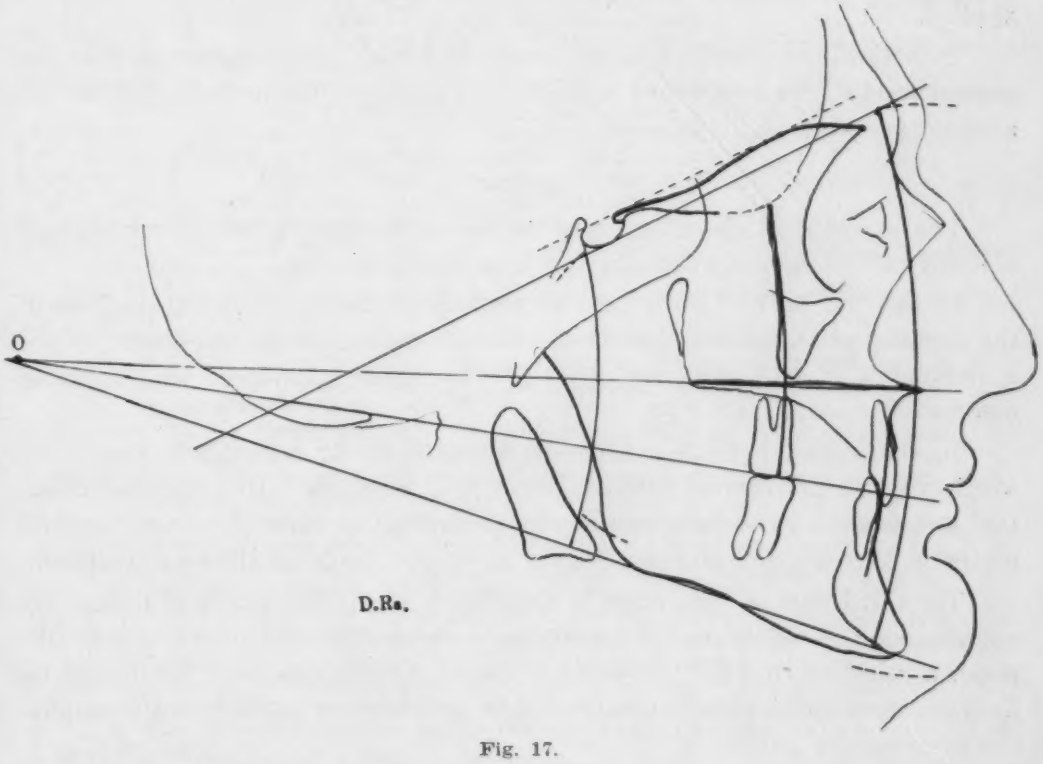
Fig. 15.

Fig. 14.—Tracing of Patient T. S. superimposed on tracing of Patient R. B.
Fig. 15.—Patient M. J. (supplement of Case 5).

Fig. 16.



H. B.



D. Ra.

Fig. 17.

Fig. 16.—Patient H. B. (supplement of Case 5).
Fig. 17.—Patient D. Ra. (supplement of Case 5).

In the case of Patient M. J., who has the upper face of the father and the lower face of the mother (neither of the parents has a biprotrusion), I will lean, all other things being equal, toward extraction.

From a sample of fifty children with normal occlusions, H. B. (Fig. 16) presents a bidental protrusion and retrusion of the mandible. Among the cases with normal occlusion, this is the one which shows the closest similarity to Case 5. At the opposite extreme is D. Ra. (Fig. 17) presenting a bidental retrusion accentuated by a strong chin button.

CONCLUSIONS

From the previous examples, some considerations are emergent:

1. *Individuality* of the orthodontic patient should be recognized:

   Individuality of each one's particular facial pattern assessed in three dimensions.

   Individuality of each one's particular malocclusion (as related to the facial structures).

   Individuality of genetic background and present status.

2. *Differential diagnosis* (symptomatic and etiological) should be made without regard to class of malocclusion. There is an optimum for each patient.

3. *Differential treatment* is the logical consequence of the differential diagnosis. There is, for each case, a most economical intervention to be assessed and applied.

In orthodontic research many questions are as yet unanswered. At the present level of our knowledge, it is felt that the foregoing propositions provide a temporary working hypothesis.

SUMMARY

I have presented an evaluation of the role of roentgenographic cephalometric analysis in orthodontic diagnosis and treatment planning.

In the first part of the article a three-dimensional geometrical analysis of the dentofacial complex is described. Norms leading to the assessment of the individuality of each child are defined. This, in essence, leads to differential diagnosis.

In the second part an evaluation is made of the orthodontic treatment, which may be preventive, passive, active, and retentive. In active treatment the forces used have been considered according to their direction—antero-posterior, vertical, or transverse. This, in essence, leads to different treatment.

The third part of the article is a synthesis of the two previous parts. By confronting the differential diagnosis with the therapeutic forces at our disposal, a selective treatment is decided upon. This synthesis is illustrated by five case reports which are supplemented by a number of special cases to emphasize some specific points.

In conclusion, attention is focused on the individuality of the patient, on differential diagnosis, and on differential treatment.

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ARCH LENGTH DEFICIENCY IN THE MIXED DENTITION

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ARCH length deficiency is, of all kinds of malocclusion, the kind most frequently encountered. Even casual inspection suggests to the observer that size of the teeth has something to do with it. The mother of the patient sometimes volunteers the deduction that the child inherited a delicate jaw structure from the maternal side but, unfortunately, got a set of large teeth from the father.

Orthodontists were tardier in adopting a dimensional concept of the arch length problem, and it was not until the middle forties that this occurred. True enough, Pont, Stanton, and Hawley had offered procedures involving measurement, but these were essentially guides for arch form.

The failure to treat arch length deficiency as a clinical entity susceptible of measurement had a twofold basis. For a long time, a really critical appraisal of orthodontic attainments had no appeal for the specialty. One gathered from the literature that attempts to improve facial esthetics, jaw relationships, or crowding were all uniformly successful. A profession which can overcome all its problems need not make petty distinctions between large ones and small ones. Second, the general acceptance of "mesial drift" as the etiological basis of crowding suggested such an obvious solution (restore the teeth to their original position) that the size of the teeth seemed to be of little consequence.

The publication in 1947 by Nance[1] of a long-term study of the dimensions of the lower dental arch had a profound influence in orthodontics. Previously, orthodontists had sought to develop room for teeth by (1) forward movement of anterior teeth, (2) lateral movement of canines and premolars, or (3) distal movement of molars and premolars. Many orthodontists were displeased with the esthetic and other aspects of expansion therapy and sought to move molars distally as a means of gaining arch length without extraction. Whether or not the dental arches were crowded, the loss of deciduous teeth anterior to the first permanent molars was cause for alarm. This was so whether the loss was occasioned by ectopic eruption of the permanent lateral incisor or by dental caries. The basis for concern was the assumption that throughout life the first permanent molar drives inexorably toward the midline and that this tendency is hastened by the premature removal of any tooth structure anterior to that molar.

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Nance reported dimensional changes that he had observed in a substantial number of cases, in patients followed sufficiently long to make his observations not only reliable but impressive. He was inclined to leave to the reader the formulation of lines of action predicated upon his observations. In spite of this chariness on the author's part, his article immediately began to influence clinical procedure. Nance demonstrated that deficiencies of arch length could be overcome temporarily through treatment, but all too often alterations of tooth position in the postretention period brought about a return to arch dimensions equal to or less than those presenting in the original condition.* In most cases, measurements were not necessary to demonstrate that this was so. Inspection of original and terminal models gave silent but eloquent testimony of relapse. While other factors were operating at the time to lead orthodontists to look with favor upon extraction, the publication of this article and of a second by Nance[2] a month later undoubtedly did much to change the views of men who once denounced removal of teeth. Since a permanent increase in mandibular arch length was appearing to be a chimera, deliberately decreasing it seemed the only alternative means for eliminating crowding.

Nance's observations, based upon the transition from mixed dentition to permanent dentition, had particular impact. This observation was based not on treatment, but on cases in which an attempt had been made to capitalize on the size difference between mandibular deciduous molars and the premolars which succeed them. For some time he had measured in the mixed dentition available space for succedaneous teeth. Widths of permanent teeth were taken from intraoral films. In many patients exhibiting crowding in the mixed dentition, the basis for the crowding was apparently excessive width in deciduous molars. At least, measurements around the arch indicated that between the first permanent molars there was sufficient room to align evenly the ten permanent teeth, even though irregularity might present itself in the anterior segment at the mixed dentition stage. In these cases it was Nance's practice to place a "preventive arch"—a lingual arch wire which would maintain distance from molar to molar and from molars to incisors. This was to allow permanent teeth to erupt into spaces gained by exfoliation of their predecessors, preserving "leeway" which otherwise might be lost through mesial molar drifting. Postretention observation revealed that this could lead to even alignment of a permanent nature, but *only* when measurements demonstrated that there was not only room for the ten teeth but an additional amount to spare. Thus, it came to be thought inevitable that arch dimensions would decrease on the transition from mixed to permanent dentition, regardless of whether or not the arch had been treated orthodontically.

An equally important incidental or corollary conclusion was derived: if first permanent molars could not be held in the positions in which they erupted, what prospects were there for moving them distally in order to gain arch length? With widespread disillusion in the profession concerning the

*For certain important exceptions and qualifications, the reader is referred to Nance's original article.

expansion of buccal segments or forward movement of anterior teeth, this seemed to remove the last hope of dealing with arch length deficiency without extractions.

THE PRESENT STUDY

Shortly after the publication of Nance's article, we began a serial study of certain clinical procedures which might be profitably compared with one another and which suggested themselves in the light of Nance's findings.

The work originally included seventy-two children in the mixed dentition, with thirty-four at the end of the period of study. In each instance complete intraoral films, cephalometric films, and plaster models were obtained; when these records were complete, mandibular deciduous canines were removed in several of the children. This was done because there was crowding in the mandibular anterior segments (twenty-three cases) and the extractions were intended to alleviate it, or because one deciduous canine had been lost and we sought to restore symmetry (six cases). In four other cases both canines were lost prematurely without our ordering extractions. One remaining case offered no justification for extraction, and none was performed. At intervals of approximately eighteen months the complete set of records was repeated for each child in the study.

Some attrition in numbers of persons must be expected in a study of this sort, and, what with changes of residence or unwillingness to continue, thirty-four (nineteen boys and fifteen girls) remained in the group for the entire span. This loss of patient material is not so calamitous as it might seem. The most informative years were often the initial ones and, furthermore, it will be seen that the conclusions are such that they do not require large numbers to make them credible.

Following this group of children for virtually a decade afforded an opportunity to make observations bearing on (1) characteristics of the permanent dentition resulting from the premature removal of mandibular deciduous canines (2) the reliability of predicting eventual arch length from measurements made during the mixed dentition, (3) estimates of the mesiodistal width of unerupted canines and premolars based upon the widths of mandibular incisors, as compared with the measurement of these widths from intraoral films, and (4) the positional changes, if any, of incisors and molars over such a span of years.

QUALITATIVE OBSERVATIONS

In an effort to establish conditions likely to prevail in a private office, precautions and procedures were adopted which were considered to be in the best interests of the individual child; this seemed preferable to an artificial situation of comparable "control" groups. In any event, this early decision now precludes conclusions based on such comparisons, since certain groups which one might be tempted to compare are *not* comparable. For example, eleven of the thirty-four had no appliance placed during the entire period of observation, while twenty-three wore the preventive lingual arch as described by Nance.

Seven of the eleven who wore no appliance showed improvement in the mandibular arch following the deliberate extraction of deciduous canines: manifestations of crowding would disappear, rotations would be reduced, or the midline would shift desirably. On the other hand, these desirable events were observed in but twelve of the twenty-three who wore lingual arches. In reiteration of our warning that comparisons are not warranted, it must be said that the original decision as to whether appliances were to be placed was based on individual characteristics and, as a consequence, the more severe problems at the outset were designated to wear appliances. A failure to take this into account might lead one to the unwarranted conclusion that the lingual arch is a hindrance to improvement; actually the relatively better record for the "no appliance" group merely reflects the circumstance that these patients were better off from the start than the ones selected to wear lingual arches.

One comparison of these two groups is perhaps valid, and it affords a practical lesson. This relates to the average frequency of visits of the patients with appliances and of those without. With no rigid plans formulated in advance as to frequency of visits, patients were seen on an "as necessary" basis, as determined by the investigator. The average interval between appointments for patients without appliances was three and one-third months, but for those with lingual arches it was one and one-third months. The wisdom of checking an appliance regularly cannot be disputed, but these figures suggest that compelling reasons should be present before appliances are placed. If one can safely omit appliances, he will avoid tedious and time-consuming supervision.

Lloyd[3] recommends the use of the lingual arch when mandibular second deciduous molars are removed for strategic purposes. In other situations he seems to share our present view that the lingual arch may often be omitted with safety in serial extraction procedures. Nance long ago observed that mandibular second deciduous molars could effectively prevent forward drift of first permanent molars, as long as adequate root structure remained.

QUANTITATIVE FINDINGS

In all, there were twenty-nine cases affording usable data following the extraction of deciduous lower canines. The average age at which the deciduous canines were removed was 8 years 2 months, and the average age at the time of terminal models was 12 years 8 months. Results may be best analyzed by dividing the entire number into approximately three groups, on the basis of the subsequent clinical procedures adopted. This is set forth in Table I.

Group A, like the other two groups, consisted of children in whom deciduous lower canines had been removed, but in this particular group no appliance was ever placed during the period of observation and no permanent teeth were removed.

The children in Group B had no permanent teeth extracted but wore lingual arches.

Group C consisted of children who wore a lingual arch over a comparable period of time and also had permanent teeth extracted. In most cases these teeth were the four first premolars.

In order to study arch width characteristics in all of these children, measurements of intercanine width were made periodically. In the earlier stages this measurement was taken between the tips of the cusps of deciduous canines and later between the tips of the cusps of permanent canines. Obviously different structures are being measured at the beginning and the end of the study, but this does not seem to us so serious an objection that we should deprive ourselves of the information.

TABLE I

GROUP	NO.	LINGUAL ARCH?	PERMANENT TEETH EXTRACTED?	INTERCANINE WIDTH INCREASE (MM.)	MOST ANTERIOR INCISOR LINGUAL MOVEMENT
A	10	No	No	+1.8	Minimum 0.0 Maximum 3.5 Average 1.7
B	9	Yes	No	+1.3	Minimum 0.0 Maximum 2.0 Average 0.8
C	10	Yes	Yes	+3.2	Minimum 0.1 Maximum 5.1 Average 2.2

Column 5 of Table I depicts average increases in intercanine width in the three groups. It is possible to compare these figures with two different studies in the literature in which no teeth, deciduous or permanent, were removed as a part of therapy. A chart by Barrow,[4] based on a serial study of fifty-one children with normal occlusion, shows no net change in this measurement between 8 years 2 months and 12 years 8 months. A similar study by Lewis[5] shows an increase of 1.8 mm. between 8 years 2 months and 12 years of age, the cut-off age of Lewis' report. These data suggest, when compared with ours, that the premature removal of mandibular deciduous canines does not adversely affect the final mandibular intercanine width. We found the largest increase in intercanine width in the children in whom permanent teeth were removed. This was probably due to the distal drifting of the permanent canines into the spaces left by the extraction of the first premolars. The divergence of the buccal segments of the dental arch would thus account for finding the largest average intercanine width increase in Group C.

Information thus far reported could best be obtained from plaster models. However, plaster models afford no reliable measurements of change in the sagittal plane with respect to the supporting base; serial headfilms are ideally suited for this purpose. The cephalometric films taken concurrently with the plaster models were therefore used to study changes in height and depth.

Vertical changes in molars and incisors of the mandibular arch were carefully scrutinized to determine whether or not the presence of a lingual arch would influence these variables and whether or not they are affected by the

extraction of permanent teeth. Measurements were as indicated in Fig. 1. The line tangent to the lower border was established as a base line and perpendiculars were erected, one to the distal marginal ridge of the molars and another to the incisal edge of the most anterior incisor. Increases in each perpendicular were expected; until actual data were accumulated, it was presumed that the increases would be approximately equal to one another. Consequently, this report will stress the extent to which this did not occur.

Observations on these twenty-nine cases suggest that many factors other than the two delineated here operate to affect these variables. Certainly the following findings cannot be explained in simple terms by saying that (1) teeth were or were not extracted or (2) lingual arches were or were not utilized.

The A group (no permanent teeth extracted, no appliance placed) showed the most inconsistent behavior. The molars erupted more than the incisors in four of the ten cases, the greatest difference being 2.7 mm. In the other 6 cases the incisors erupted more than the molars, the greatest difference here being 5.1 mm.

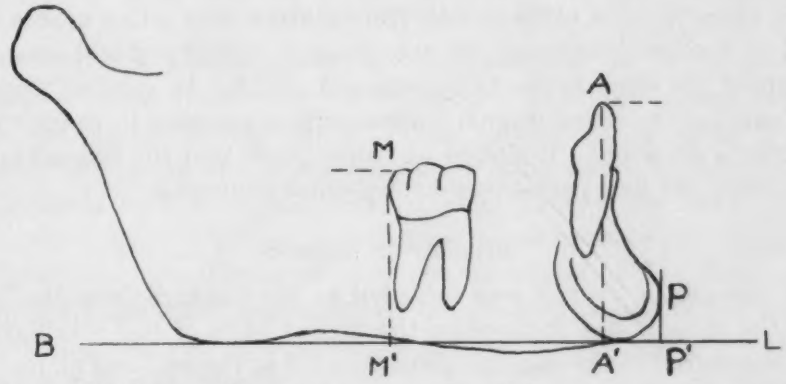

Fig. 1.—Changes in positions of permanent mandibular first molars and the most anterior incisor were measured on the tracings of the serial cephalometric roentgenograms as follows: horizontal position of molar = $M' - P'$ along base line $B - L$; of incisor = $A' - P'$; vertical position of molar = $M - M'$; of incisor = $A - A'$.

The B group (lingual arch placed, no permanent teeth extracted) was more consistent in this measurement. In only one of the nine cases in this group did the molar erupt more than the incisor, and that by only 0.3 mm. The incisors erupted more than the molars in the other eight cases, the greatest difference being 2.8 mm. and the average 1.2 mm.

In the C group (permanent teeth extracted, lingual arches placed) nine of the ten were measurable. The molars erupted more than the incisors in three cases, the greatest difference being only 0.5 mm. The incisors erupted more than the molars in the other six cases, the greatest difference being 3.0 mm.

HORIZONTAL CHANGES

Horizontal movements were measured on the headfilms as in Fig. 1. With a line tangent to the lower border of the mandible as a base line, perpendiculars

were erected, one through the distal contact of the mandibular first permanent molar, one through the incisal edge of the most anterior mandibular incisor, and one through pogonion. Tracings were superpositioned on this base line with the centers of the symphyses registered. Corrections were made in the few cases in which the pogonions did not coincide.

In no case did the most anterior mandibular incisor move labially in relation to pogonion. In two cases it remained stationary, and in all others it moved lingually. Table I shows the degree of this lingual movement in the three different categories. Because deciduous canines were removed, it is tempting to attribute this lingual movement of the most anterior mandibular incisor to that circumstance. However, Schaeffer's[6] serial study of a group of untreated cases (7 to 21 years of age) showed the incisors invariably to be in a more posterior position on the base with the passage of time.

One of us (W. L. W.) has long contended that when one broke the integrity of the lower arch by extracting deciduous canines, a lingual holding arch should be placed to prevent untoward lingual movement of mandibular incisors. Comparison of the A and B groups with respect to anteroposterior change lends no support to this a priori pronouncement. These results suggest that there is little to be gained from placing preventive arches following removal of deciduous canines. On the average, stability of molars and of incisors is about the same in the two groups, A and B. In spite of this, many of us will continue to place lingual arches as a precaution in cases where arch length is at a premium. It should be remembered that the lingual arch serves also to control the first permanent molars which support it.

OVERJET OF INCISORS

The amount of overjet was recorded as the distance from the labial surface of the mandibular incisors to the incisal edge of the maxillary central incisors, measured in the sagittal plane parallel to the occlusal plane. Presumably, if this value were to change because of procedures followed in this group of patients, it would be on the basis of lingual movement of mandibular incisors, and we have already indicated that no distinctions could be made on this score between the three groups. Determinations of overjet as followed serially reinforce this impression. The greatest increase in overjet observed was 3.0 mm., seen once in the A group and once in the C group. An increase of 2.5 mm. occurred once in the B group. Four of the A group remained unchanged with respect to overjet, as did one in the B group and three in the C group. Clearly, no meaningful conclusion is to be drawn here, unless it is to reiterate the previous point that the lingual arch cannot be counted on inevitably to maintain the status quo with respect to overjet.

MIDLINE RELATIONSHIPS

The premature removal of two deciduous canines simultaneously would seemingly permit, if not invite, shifting of the mandibular permanent incisors so that the midline might be altered. In the majority of cases, however, no

change occurred. Those that improved were offset by those that became worse; changes in the midline in discrepancy cases are probably dependent to a great extent on whether or not the mandibular permanent canines erupt simultaneously. One mandibular permanent canine erupting several months earlier than the other will exert lateral pressure against the erupted mandibular permanent incisors and change the midline.

ROTATIONS IN MANDIBULAR INCISORS

Of the total number of mandibular incisors (108), fifty-nine were rotated at the outset; thirty-nine of these showed definite improvement at the end of the study; six became worse, probably because of medialward pressure from erupting permanent canines (five in B group, one in C group). An interim report[7] by one of us (H. R. F.) suggested that eruption of permanent canines would bring a decrease in the distance between the distal surfaces of the permanent lateral incisors. In the twenty-three cases available for final measurement, ten showed such a decrease; however, nine showed an increase in this distance, and four remained unchanged.

PREDICTIONS OF ARCH LENGTH

If predictions are made concerning dimensions of the dental arches, they assume that original dimensions will change not at all or in some fashion upon which one can count. Moreover, if these predictions are to have practical significance, they must not be susceptible of being overturned by treatment. These conditions were seemingly fulfilled when Nance made known his observations: a permanent increase in arch length was possible only under certain limited conditions; *shortening* of arch characterizes the transition from the mixed to the permanent dentition; within reasonable limits the amount of this shortening may be anticipated, and it is not modified by orthodontic intervention, active or passive.

Whereas Nance measured unerupted teeth from roentgenograms, Carey[8] soon pointed out certain advantages in estimating the amount of unerupted tooth structure from the mesiodistal widths of teeth measurable in mixed dentition models. Thus, when rotations of unerupted teeth or poor film quality made reliance on roentgenograms inadvisable, the widths of the lower canine and two premolars of one side were predicted from the sum of the widths of the lower incisors. Carey based his figures on mean values derived from a substantial number of models wherein all the permanent teeth were fully erupted.

Ballard and Wylie[9] later used a separate and larger sample to develop a regression formula which led, it turned out, to the same numerical values suggested earlier by Carey. They tested the possibility that accuracy would be enhanced if a measurement of the first permanent molar entered into the basis of prediction. This was found to be true, but not to such an extent as to justify the additional trouble. Thus, their published monogram used only

measurements of incisors. They went on to show that, in the long run, this kind of prediction was more reliable than taking measurements from intraoral films. This report will show that the latter observation, true at the time it was made, now requires some qualification.

PREDICTION IN THE PRESENT STUDY

For each subject in the study, the "space available" for succedaneous teeth was determined as follows: By the use of fine-pointed dividers, the mesiodistal width of each nonrotated tooth was determined and transferred as a tiny pinhole in the record card. These were arranged in a straight line, and to them were added measurements of any spaces, plus measurements of the *space occupied* by rotated teeth. It will readily be seen that the total space so pricked out on a line of the record card constitutes the amount of space available for succedaneous teeth, provided that our presumptions are accurate. Our working hypothesis assumes that they are but remembers that actually this distance shortens. Accordingly, we accept the arbitrary figure of Nance (1.7 mm. on each side), and when we determine "space available" we deduct 3.4 mm. from the value obtained by the procedure described above.

The determination of space available takes on meaning as we discover what demands are to be made upon it. The mixed dentition models permit accurate measurement of the mandibular incisors, and the task remains to find the widths of teeth as yet unerupted. In this study two separate methods were used for each subject for the sake of comparison: direct measurements of intraoral films, on the one hand, and predictions from the Ballard-Wylie chart on the other. Relative accuracy was ultimately determined from measurements of the teeth in question, taken from the final models.

Any difference between "space available" and "space needed" was termed either "leeway" or "discrepancy," depending upon which of the two measurements was larger.

Our procedures have been set forth in this much detail simply to get them into the record. Certainly they represent no new procedure which requires elaboration. Indeed, in the last decade they have been widely adopted by others and sometimes pressed with a finality which we think unwarranted. These measurements are not, for instance, measurements of "basal bone"—they simply measure tooth relationships at a given time as they are affected by growth to date, environmental influences upon the teeth, etc. The presumption is made that factors governing tooth position will remain unchanged (or change in predictable fashion) to a sufficient degree that measurements made at one time will have validity at another. No "bone," basal or any other kind, is ever measured.

The reliability of these measurements depends on many things. The presumption of accuracy relies heavily on Nance's observation that the transition from mixed to permanent dentition always is accompanied by a shortening. In this connection, it should be remembered that Nance suggested the figure of 3.4 mm. not as inexorable law but as the average difference between these

deciduous teeth and their permanent successors. Individual departures from this amount of shortening would lead to individual inaccuracies of prediction when this value is used.

The ten subjects of Group A (who wore no lingual arches) showed an average reduction of arch length of 2.9 mm.; six showed a reduction less than Nance's 3.4 mm., the least being 0.9 mm. The remaining four exceeded 3.4 mm., with a maximum reduction of 5.2 mm. Because of the presence of lingual arches in the other two groups (and extraction of first premolars in Group C), only Group A was studied in this connection. The average age of the ten subjects in Group A was 12 years 8 months when terminal measurements were taken. Schaeffer's work suggests that further shortening could take place.

Interpreting these dental changes in relation to the mandibular base as seen in the headfilms (Fig. 1) reveals that arch length reduction should not be attributed entirely to forward migration of molars. In four of the ten cases in Group A the molars moved *posteriorly* in relation to pogonion, one as much as 2.3 mm. This was observed in three of the nine cases in Group B. Group C, in which premolars were removed, showed more of a tendency for molars to move *toward* pogonion, averaging 1.0 mm. (The average for Groups A and B was 0.0 mm. toward pogonion.)

The incisors, on the other hand, showed a pronounced tendency to shift posteriorly. This amounted to as much as 5.0 mm. of change as measured from pogonion, recorded once in Group A. Lingual positioning of the more labially placed incisors is so characteristic that it failed to occur in but two cases of the entire series; in these two there was no change. In only three of the ten Group A cases did the molar move toward the incisor more than the incisor toward the molar. Even in these three cases the incisor moved posteriorly in relation to pogonion. In the remaining seven cases the incisor moved toward the molar more than did the molar toward the incisor. In four of these seven cases the molar moved away from pogonion.

This tendency for incisors to move lingually may have been enhanced by the removal of primary canines; whether or not this is so, our observations indicate that a lingual arch is not effective in preventing it.

FACTORS AFFECTING ACCURACY OF PREDICTION

Measuring the width of a tooth on a model or on a roentgenogram may introduce an error of 0.1 mm. at each point of the dividers, for the human eye at normal viewing distance can distinguish no closer than 0.1 mm., according to determinations by Philleo.[10]

A check on the relative accuracy of different methods of prediction based on measurements, in order to be complete, should not fail to consider the degree of error introduced by measurement itself without regard to the original material being measured. Consequently, a test was devised which utilized an easier medium than plaster models or x-ray films, namely, a metal millimeter rule in which the calibrations were engraved into the metal and filled with black enamel for contrast. To simulate the clinical situation, each

man cooperating in the study was asked to use sharp-pointed dividers to prick out on the line of a card a total distance of 70 mm. in the following fashion: He would first set his dividers at 9 mm. on the metal scale and transfer the measurement to the card; then he would set the dividers at 8, 7, 6, and 5 mm., respectively, and repeat the process. This obliged him to reset the dividers after each measurement, and the total distance of 70 mm. approximates the distance ordinarily encountered clinically. Accuracy of the test was appraised by measuring the distance between the first and last pinholes with the same metal scale. One might expect that small errors introduced by the human factor would tend to cancel out, that is, errors on the small side would occur as frequently as errors of magnification. On the contrary, of the twenty tests conducted by six different persons, only two were under a total of 70 mm., one was exactly correct, and the remainder were over the correct figure. The median result of twenty measurements was 70.5 mm., with a range of 69.7 to 70.9 mm. This suggests that under ideal conditions the technique of transferring measurements to a line on a card tends to err slightly in the direction of magnification.

RE-EVALUATION OF ROENTGENOGRAMS VERSUS PREDICTIVE FORMULAS

The passage of ten years has permitted a reappraisal of the predictive formula of Ballard and Wylie. They tested its accuracy against measurements of unerupted canines and premolars as seen in intraoral films. In order to find a group of children whose models in 1947 showed these teeth fully erupted for measurement by dividers, they were obliged to use intraoral films of a considerably earlier date than 1947. The present study, however, has the benefit of films taken by the so-called "long-cone" technique which minimizes size distortion.

Table II permits comparison, case by case. With films meeting a much higher technical standard, the tables are turned and the films come off with a better rating for the prediction of mesiodistal widths of unerupted teeth.

TABLE II. NANCE ANALYSIS COMPARATIVE ACCURACY OF PREDICTION

CASE NO.	X-RAY		FORMULA	
	INCREASE (MM.)	DECREASE	INCREASE (MM.)	DECREASE (MM.)
A	1.5			0.6
B	2.0		1.5	
C	1.5		3.7	
D	0.7			2.2
E	0.4			0.9
F	0.6		0.9	
G	1.2		0.3	
H	2.2		0.9	
I	1.4		0.2	
J	1.3			2.6
K	0.4		0.2	
L	0.0			3.8
M	0.0			3.2
N	2.0		3.2	
O	1.1			1.9
P	2.1		2.1	
Q	0.3			2.3
R	0.9			3.5
S	2.0		0.4	

Whether predictions of arch length deficiency are based on good x-ray films or upon mathematical formulas, caution should be used in deciding to extract permanent teeth on these grounds alone. Measurements of the terminal models determined what we called "final discrepancy." With high-quality films, our errors ranged from overestimating discrepancy as much as 4.0 mm. to underestimating it by 1.6 mm. With the predictive formula, the extreme overestimate was 3.9 mm., while the extreme underestimate was 5.7 mm. These errors seem large when compared with Table II. It should be remembered that human error can affect both the estimate of space available and the estimate of space needed; when one errs in one direction while measuring one and in the other direction while measuring the other, the two combine to make a truly magnificent miss.

Table II depicts the relative error encountered in predicting the total mesiodistal widths of unerupted mandibular canines and premolars, using predictive formula, on one hand, and intraoral films taken at a minimal target distance of 16 inches on the other. Measurements of models taken after the eruption of the teeth in question determine the accuracy of the previous predictions.

SUMMARY AND CONCLUSIONS

A study of thirty-four children utilizing headfilms, plaster models, and intraoral films taken at appropriate intervals suggests the following conclusions:

1. Premature removal of primary canines has no adverse effect upon ultimate intercanine width.

2. When premature removal of primary canines was indicated, placing a lingual arch had dubious value in this series of patients, whether it was intended to prevent lingual positioning of incisors or to prevent forward positioning of molars. Lingual arches are certainly useful where second primary molars are lost or where their loss is imminent.

3. Arch length shortens in the transition from the mixed to the permanent dentition, and the basis for this shortening differs in different persons. In most instances the shortening can be attributed more to a lingual shifting of incisors upon the symphysis rather than to a forward shift of molars.

4. Prediction of arch length deficiency in the permanent dentition, based upon measurements made during the mixed dentition, is sufficiently inaccurate that caution should be exercised in applying such predictions clinically. While mesiodistal widths of unerupted cuspids and premolars may be predicted from measurements of incisors with more accuracy than one can measure these widths in poor intraoral films, films taken by a meticulous technique can outperform the mathematical formulas. Whether films or formulas are used, however, appreciable errors in prediction can occur.

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In Memoriam

ABRAM HOFFMAN
1875-1958

ABRAM HOFFMAN, 83, of Plantation, Fort Lauderdale, Florida, died on Sunday, Feb. 23, 1958, in the North Broward General Hospital.

Dr. Hoffman was born in Fort Plains, New York, on March 4, 1875, a son of Abram Hoffman, Sr., and Carolyn King, prominent pioneers of the state of New York, with a heritage going back to Revolutionary days. His father served as sheriff of Montgomery County and was a member of the House of Assembly of New York State.

Dr. Hoffman's prefatory education was attained at the Clinton Liberal Institute in Fort Plains and at the University of Buffalo, from which he was graduated in 1899.

He lived in Syracuse from 1899 to 1906, at which time he accepted a position at the University of Buffalo Dental School, where he served as Professor of Orthodontics and Prosthetic Dentistry from 1907 to 1919. He was head of the Department of Orthodontics of the University of New York from 1924 to 1927. In 1927 he became head of the Department of Orthodontics and Dean of Students of Northwestern University Dental School. He remained at Northwestern until his retirement in 1939 as president emeritus. He was highly esteemed by his students at the aforesaid universities.

Dr. Hoffman made many contributions to his chosen profession in the field of orthodontics, literature, lectures, and services.

His affiliations in part were as follows: national president of Xi Psi Phi fraternity in 1912; president of the Eighth District Dental Society of New York State in 1911; a member of the Omicron Kappa Upsilon honorary fraternity; the first secretary of the American Board of Orthodontics; secretary-treasurer of the American Institute of Dental Pedagogics (a position he retained after the Institute united with the American Institute of Dental Teachers); secretary of the Dental Index Bureau to Dental Periodic Literature; a fellow in the American College of Dentists; a member of the Dutch Reformed Church; a member of the Sons of the American Revolution; and formerly a member of the University Club of Chicago, and the Exmoor Country Club of Highland Park, Illinois.

He lived in Buffalo, New York, from 1907 to 1927; in Highland Park, Illinois, from 1927 to 1941; in Miami Beach, Florida, from 1941 to 1951; and at Plantation, Fort Lauderdale, Florida, from 1951 to the time of his death.

He was the founder and first president of the Plantation Home Owners Association and occupied the position of president emeritus until his death. Prior to the actual incorporation of Plantation as a city in Florida, it simulated a Fort Lauderdale suburb. He was affectionately known as the "Mayor of Plantation" and certainly occupied a unique position as Plantation's "first citizen."

ABRAM HOFFMAN

To indicate the strength of this position, it may be noted that there was a wreath on the door of the Plantation City Hall the day of his funeral and the City Hall flag flew at half-mast.

Surviving are his wife, Helen Bartrom Hoffman; a son, Burton A., a practicing orthodontist in Buffalo, New York; and a daughter, Miss Hester Hoffman, of Walnut Creek, California.

Be it resolved that this tribute be made a part of our permanent record and that a copy be mailed to Dr. Hoffman's family.

Respectfully submitted,

Arlo M. Dunn
H. B. Singler
Leonard P. Wahl, Chairman
Necrology Committee

Department of Orthodontic Abstracts and Reviews

Edited by
DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Twitching of the Facial Musculature. By Ivor Scher. *Brit. Dent. J.* **103**: 311-313, 1957.

Several types of twitching of the facial musculature may be distinguished. The following classification is suggested:

(a) Psychogenic tics.
(b) Rare idiopathic spasmodic facial spasm.
(c) Spasmodic contractions of the facial musculature following nerve injury or paralysis.
(d) Other spasmodic motor abnormalities involving the facial musculature.

Mayer-Gross, Slater, and Roth define a tic or habit spasm as any sudden, quick, frequently repeated and purposeless movement. This may occur in any part of the voluntary musculature.

Some examples of tics are twisting the mouth, grimacing, and forehead wrinkling. It is possible to distinguish tics from other habitual manipulations of the body, such as thumb-sucking. These conditions do not have the sudden onset, and they are not repeated in the photographically identical form. The provision of pleasure is their obvious purpose. Subjectively, they are controllable and, finally, they differ from psychogenic tics because they always involve two parts of the body at the same time, one of which is usually the hand. Girls and boys were equally affected. The condition is much more frequently seen in childhood than in later life.

The cause of the habit may be found in a local stimulus; it may be fully explicable neurologically, and it may be of organic origin. Colyer and Sprawson suggest that a dental lesion may induce a tic either directly by reflex irritation or indirectly by lowering the vitality.

Tics also present themselves in a picture of general psychopathic maladjustment and neurotic difficulty. A withdrawal from the world with a concentration of interest in the body is the underlying fundamental principle. Tics, thumb-sucking, the cigarette and pipe habit, and continual gum-chewing are probably tension outlets whereby the patient satiates himself with movements of the jaw and mouth in a characteristically aggressive fashion.

A compulsive movement of the head or facial muscles initiates the condition. The variety of movements and their combinations in the same patient may be numerous. The movement is easily controlled at first. Once the movement habit is firmly rooted, the compelling desire to perpetuate it in times of emotional stress becomes a psychomotor haven of refuge. Sleep, the influence

of suggestion, and preoccupation with some other activity cause cessation of the movement. Unfortunately, if the tic which is the manifestation of the conflict compromise is resisted for a prolonged period, the compulsive tic symptom reappears with fresh vigor.

If eradication of suspect lesions of dental or related tissues fails to resolve the condition, then treatment should be placed in the hands of the psychiatrist. Pacification and desensitization of the home atmosphere are essential. The treatment of the actual habit itself, from the beginning, must remain the sole concern of the psychiatrist. In many instances, therapeutic success has been achieved only with very prolonged analysis. Ten cases investigated by the writer, with removal of suspect dental lesions, all required psychiatric treatment.

Your Child's Teeth. A Guide for Parents. By Edgar S. Bacon, D.D.S. (Foreword by C. Raymond Wells, D.D.S.) New York, E. P. Dutton and Company, Inc., 1957. 124 pages. Price, $2.50.

In his introduction to this book, C. Raymond Wells points out that it helps fill a need for dental health education of parents. We often feel that the modern parent is quite well educated on this subject but that it is the dentist who falls short of his duty in answering the questions of otherwise well-informed parents. This little volume contains many answers which should help the dentist when asked by parents for guidance concerning the health of their children's teeth.

Chapters are included on home care as well as on the care provided by the dentist. Information will be found also on the importance of the "first teeth" and on what are euphemistically called the "permanent" teeth. Habits, tooth injuries, and oral disease all come in for discussion.

As is true of most books intended for the public, many of the statements are too pat when considered in the light of present-day scientific knowledge. The answers are there, however, and the parent or dentist who seeks further information will have to resort to collateral reading.

Bacon is to be congratulated for his avoidance of technical terms and pseudoscientific jargon which tend to discourage the lay reader. As reception room literature and as a means of learning how to answer questions in terms understandable to laymen, this book will be found of value.

J. A. S.

The Aleut Dentition: A Correlative Study of Dental Characteristics in an Eskimoid People. By Coenraad F. A. Moorrees. Cambridge, Harvard University Press, 1957. 196 pages. Price, $4.50.

The Aleutian Islands constitute a chain of barren, volcanic islands on the western end of the Alaskan Peninsula. These islands, which lie on the same latitude as London, have a mild climate and an abundance of fog and rain. Moorrees presents here his findings as odontologist of the expedition sponsored by the Peabody Museum of Harvard University in 1948.

Diseases, such as tuberculosis and venereal infection, plus the unsatisfactory economic condition are responsible for the declining Aleut population, so that in 1948 the expedition found 148 persons of all ages inhabiting the islands. The eastern Aleuts differ from those occupying the more western islands. The latter are shorter, while the eastern Aleuts have a higher cephalic index, greater bizygomatic breadth, and greater face height, and show a higher frequency of blood groups O, B, and type N.

Among the oral morphologic characteristics found are shovel-shaped incisors and canines. Moorrees found a comparatively low frequency of Carabelli's cusps and frequent absence of third molars. Torus palatinus and mandibular tori were common. Odontometric studies show less variability in the anterior teeth than in those more distally situated. Numerous instances of maxillary-mandibular dysplasias with resultant malocclusion and tooth crowding were found in the Aleuts. Mandibular prognathism was found more commonly than in white populations and pointed to positive genetic influence.

Moorrees' findings largely confirm those of other investigators on the dentition of Eskimos. He casts doubt on some accepted theories and points out the need for further anthropologic odontologic studies of primitive peoples as an aid to the understanding of present dental and dentofacial problems.

J. A. S.

News and Notes

Middle Atlantic Society of Orthodontists

The next meeting of the Middle Atlantic Society of Orthodontists will be held in Atlantic City, New Jersey, Oct. 12 to 14, 1958, at Chalfonte-Haddon Hall.

Southern Society of Orthodontists

The thirty-seventh annual meeting of the Southern Society of Orthodontists will be held aboard the luxury cruise ship "M. V. Arosa Sky."

The ship will leave Norfolk, Virginia, on Sunday, Oct. 19, 1958, for Bermuda, W. I. It will return from Bermuda, docking at Norfolk, Virginia, on Friday, October 24.

Denver Summer Seminar

The Denver Summer Meeting for the Advancement of Orthodontic Practice and Research will be held Aug. 3 to 8, 1958, at Writer's Manor, 1730 Colorado Blvd., Denver, Colorado.

The Board of Trustees have arranged the following outstanding program:

B. F. Dewel, D.D.S., Teaching Associate, Granduate Department, Northwestern University.

Principles, Procedures, and Limitations of Serial Extraction in Orthodontic Treatment.

Clinical Analysis of Arch Length Requirements in Orthodontic Treatment.

Diagnostic Importance of the Lower Arch in Case Analysis and Treatment Planning.

Early Diagnosis and Treatment of Dentofacial Growth Deficiencies.

Andrew Francis Jackson, D.D.S.

A discussion of a concept of Orthodontics, next the objections, how to estimate objectives for the specific individual and what appliance to use to obtain these objectives, and case reports. A coverage of the use of the labial arch with auxiliary springs, the lingual arch both with auxiliary springs and used as a bite plane or crib, the Johnson twin wire, and the Crozat appliance.

Robert M. Ricketts, D.D.S.

Topics of discussion to be announced.

A program of entertainment has also been arranged.

Second Congress of Stomatologists of Yugoslavia

The second Congress of Stomatologists of Yugoslavia will be held in Beograd, Sept. 18 to Sept. 20, 1958. All inquiries should be directed to the secretary of the Congress, Dr. Pavle Stošić, Stomatološki fakultet, Beograd, Rankeova 4.

Necrology Committee

American Association of Orthodontists

Please notify the Necrology Committee of the death of any of our members. This information should be sent immediately to the chairman or to any member of the Committee.

Ernest N. Bach, Chairman
305 Professional Bldg.
Toledo, Ohio

Temple University

A course in advanced orthodontics will be given at Temple University School of Dentistry, Jan. 18 to 31, 1959, by Robert H. W. Strang and associates.

For further information, please contact Louis Herman, D.D.S., Director of Postgraduate Studies, Temple University School of Dentistry, Broad above Allegheny Ave., Philadelphia 40, Pennsylvania.

Notes of Interest

Charles Heston Patton, D.D.S., announces the removal of his offices to 1702 Locust St., Philadelphia, Pennsylvania, practice limited to orthodontics.

Carl Zeisse, D.D.S., Medical Tower Bldg., Philadelphia, Pennsylvania, announces the opening of an office at 934 County Line Rd., Byrn Mawr, Pennsylvania, practice limited to orthodontics.

Forthcoming meetings of the American Association of Orthodontists:
1959—Statler Hotel, Detroit, Michigan, May 4 to 7.
1960—Shoreham Hotel, Washington, D. C., April 24 to 28.
1961—Denver, Colorado.
1962—Los Angeles, California.

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The AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and its component societies. The Editorial Board of the JOURNAL is composed of a representative of each of the component societies.

American Association of Orthodontists
(Next meeting May 4 to 7, 1959, Detroit)

President, Franklin A. Squires - - - - - - - - Medical Centre, White Plains, N. Y.
President-Elect, Edward C. Martinek - - - - - - - - - Fisher Bldg, Detroit, Mich.
Vice-President, George H. Siersma - - - - - - - - - Republic Bldg., Denver, Colo.
Secretary-Treasurer, Earl E. Shepard - - - - - - - - 8230 Forsyth, St. Louis, Mo

Central Section of the American Association of Orthodontists
(Next meeting Sept. 29-30, 1958, Cedar Rapids)

President, Frederick B. Lehman - 1107 Merchants National Bank Bldg., Cedar Rapids, Iowa
Secretary-Treasurer, William F. Ford - - - - - - - 575 Lincoln Ave., Winnetka, Ill.
Director, Elmer F. Bay - - - - - - - - - - 216 Medical Arts Bldg., Omaha, Neb.

Great Lakes Society of Orthodontists
(Next meeting Nov. 2-5, 1958, Pittsburgh)

President, Edwin G. Flint - - - - - - - - - 8047 Jenkins Arcade, Pittsburgh, Pa.
Treasurer, D. C. Miller - - - - - - - - - - 40 South Third St., Columbus, Ohio
Director, Robert E. Wade - - - - - - - - - - 327 E. State St., Columbus, Ohio

Middle Atlantic Society of Orthodontists
(Next meeting Oct. 12-14, 1958, Atlantic City)

President, Gerard A. Devlin - - - - - - - - - 121 Prospect St., Westfield, N. J.
Secretary-Treasurer, Paul A. Deems - - - - - - - - 835 Park Ave., Baltimore, Md.
Director, George M. Anderson - - - - - - - 3700 North Charles St., Baltimore, Md.

Northeastern Society of Orthodontists

President, Clifford G. Glaser - - - - - - - - - 1255 Delaware Ave., Buffalo, N. Y.
Secretary-Treasurer, David Mossberg - - - - - - 36 Central Park S., New York, N. Y.
Director, Norman L. Hillyer - - - - - - - 230 Hilton Ave., Hempstead, L. I., N. Y.

Pacific Coast Society of Orthodontists

President, Richard Railsback - - - - - - - - - 1333 Grand Ave., Piedmont, Calif.
Secretary-Treasurer, Warren Kitchen - - - - - - 2037 Irving St., San Francisco, Calif.
Director, Richard Railsback - - - - - - - - - 1333 Grand Ave., Piedmont, Calif.

Rocky Mountain Society of Orthodontists
(Next meeting Sept. 7-9, 1958, Moran, Wyo.)

President, George E. Ewan - - - - - - - - Bank of Commerce Bldg., Sheridan, Wyo.
Secretary-Treasurer, H. Carlyle Pollock, Jr. - - - 915 South Colorado Blvd., Denver, Colo.
Director, Ernest T. Klein - - - - - - - - - - Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, John A. Atkinson - - - - - - - - - 898 Starks Bldg., Louisville, Ky.
Secretary-Treasurer, H. K. Terry - - - - - - - - 2742 Biscayne Blvd., Miami, Fla.
Director, Edgar Baker - - - - - - - - - - Professional Bldg., Raleigh, N. C.

Southwestern Society of Orthodontists
(Next meeting Oct. 5-8, 1958, Little Rock)

President, Thermon B. Smith - - - - - - - - - 1122 W. Capitol, Little Rock, Ark.
Secretary-Treasurer, Harold S. Born - - - - - - - 908 S. Johnstone, Bartlesville, Okla.
Director, Nathan Gaston - - - - - - - - - - 701 Walnut St, Monroe, La.

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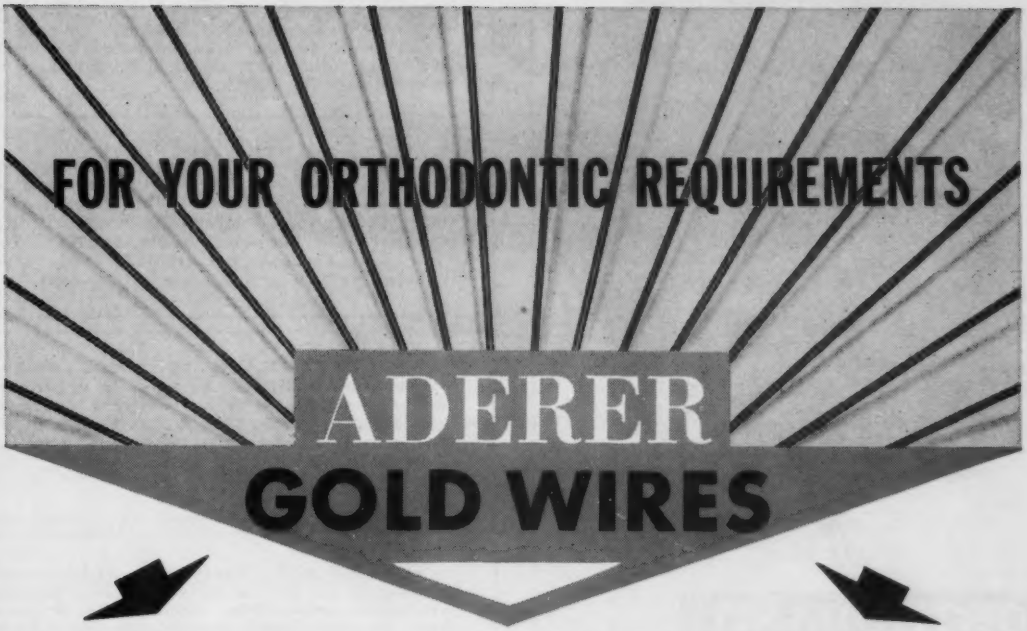

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Earlier diagnosis, new methods of treatment and a greater public awareness have contributed to this progress. It is often said that the life of the cancer patient is in the hands of the first physician he consults. The Society, therefore, conducts a broad professional education program, making available to doctors, through literature, films, exhibits, and other materials, information on the latest advances in detection, diagnosis and treatment.

As the Society aids the doctor, so does its large corps of volunteers aid the cancer patient with dressings, transportation, home care, medication and a host of other vitally needed services.

For the past two years, the theme of the Society's annual Crusade has been "Fight Cancer with a Checkup and a Check." That Americans everywhere are learning the value of the annual health checkup in the fight against cancer, is evidenced by the fact that doctors report they are now seeing more cancer in its earliest stages than ever before.

That American men and women have a personal stake in the program of the American Cancer Society is demonstrated by the public's generous support of the Crusade. This year the goal is $30,000,000 and we are confident that our people will meet the challenge... will "fight cancer with a checkup and a check" in the encouragement of further progress.

Lowell T. Coggeshall, M.D., *President*
American Cancer Society

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The Management of ORAL DISEASE

A Treatise on the Recognition, Identification, and Treatment of Diseases of the Oral Regions

by

JOSEPH L. BERNIER, D.D.S., M.S., F.D.S., R.C.S. (Eng.) Colonel, Dental Corps, United States Army; Chief, Oral Pathology Branch, Armed Forces Institute of Pathology; Pathologist to the Registry of Oral Pathology of the American Dental Association; Professor of Oral Pathology, Georgetown University of Dentistry.

1955, 825 pages, 6¾" x 9¾", 1001 illustrations,
5 color plates. Price, $15.00.

This book looks beyond disturbances of the tooth and its supporting apparatus to the diseases of the soft and hard structures of the oral regions, which have now been generally accepted as a responsibility of the dental profession. Specifically Doctor Bernier was prompted by these ideas in preparing this book:

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- To present newer concepts relating to the role of stress, and the influence of general disease on oral disturbances.
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